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Engineering News-Record

MISSOURI RIVER BRIDGE BEING WIDENED UNDER TRAFFIC

Present Status of the Hetch Hetchy Water Supply Project—Widening the Missouri River Bridge at Omaha—Lining Up a Highway Maintenance Patrol Personnel—Work Starts on Port Development at Mobile, Ala.—Abandoned Railway Grade Used for Mountain Highway

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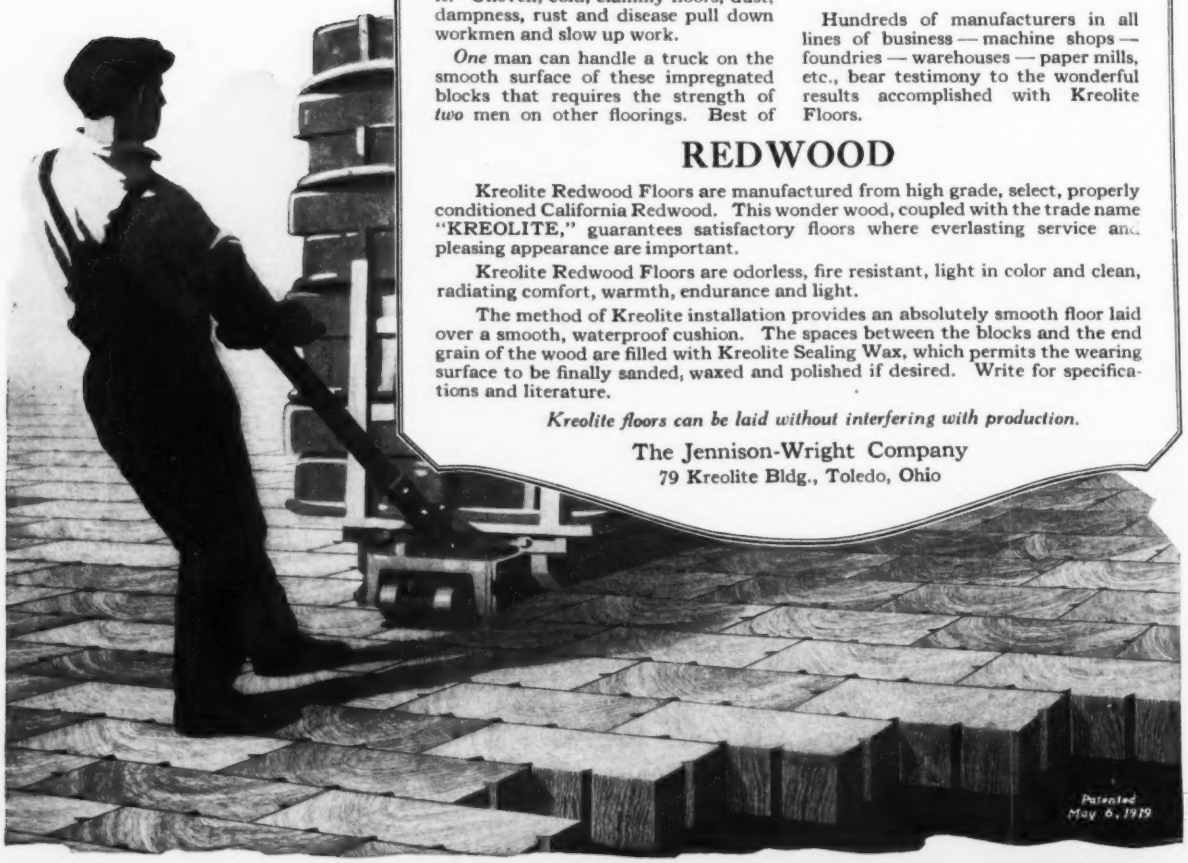

FLOORS

WOOD BLOCK

A Consolidation of Engineering News, Engineering Record and The Contractor

ENGINEERING NEWS-RECORD

McGraw-Hill Company, Inc.
JAMES H. McGRAW, *President*
E. J. MEHREN, *Vice-President*

DEVOTED TO CIVIL ENGINEERING AND CONTRACTING

FRANK C. WIGHT
Editor

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To Elevate the City Engineer

ONE thing is being made clear by the study of engineering in the small cities that *Engineering News-Record* is now conducting—the average city engineer has not the responsibility in the government nor the standing in the community that the importance of his work justifies. As a rule he ranks considerably lower than the chief of police and not much higher than the city clerk. He is a routine officer doing a routine job—so far as his fellow citizens or his superior officers see him. This is an unfair condition, unfair both to the city and to the engineer and it should be changed. But it will not be changed, except by slow education, and both the engineers and the city need educating. Part of the trouble is due to low intelligence political control, the kind of control that results when a baggage smasher is elected a city commissioner as in one of the cities visited. But that is not all. Many political city administrators are just plain ignorant of the duties and function of the engineer or the dignity of engineering. As many times as not such officials have contact with a city engineer suffering from an inferiority complex, or else scared to death for his job. Until such engineers get a little backbone the task of educating their superiors is nearly hopeless. But given a little spunk, and the aid of his fellow engineers in state, county and country, the city engineer may be able to put into his superiors some appreciation of what properly guided engineering means to the community. We hope, before this series ends, to have provided some ammunition for the conduct of such a campaign.

Contractors and Concrete Quality Control

QUALITY control as developed in recent years by the concrete technologists and as reviewed in our last preceding issue has a definite practical interest to contractors. Quite commonly they have been inclined to be somewhat intolerant of the various modern "theories" of concrete proportioning as being a handicap to output. This charge was almost the first one to be made against the one-minute mix for road work when a few years ago it was inaugurated by highway engineers. These columns at that time contained several discussions of the new practice. Now a one-minute mix is the minimum requirement for road work, many highway specifications requiring the concrete to remain 1¼ minutes in the mixer and some raising the mixing period to 1½ minutes. It is not evident from any records that the present longer mix lessens output. There are obviously several reasons for this but the article of a week ago suggests one that points a moral which bears on the contractor's attitude toward these new theories and practices of proportioning. The longer mix proved to produce a smoother working concrete—it could be handled and placed more easily and with less danger of porous spots. There was less tamping required and less spading next to the forms and there was less raking of the dumped batch to redistribute segregated aggregates. It is in reducing segregation also that the new refinements in proportioning help the contractor. They produce a concrete which "works" better and, as was emphasized editorially last week, good workmanship remains a vital requirement of concrete construction.

Road Culvert Upkeep

CULVERT maintenance is growing in importance to highway departments. Modern roads call for drainage structures of concrete or metal. These are expensive. Indeed on a surfaced road the investment in culverts is today less only than the money put into grade and surface. It needs to be conserved as carefully by upkeep and renewal of structure. It seldom is. Modern maintenance plans and action are directed primarily to surface upkeep. The patrolman's job above all is to keep his road section smooth. If he does this he can get by with a lick and a promise to his culverts. And usually that is all they get. There are a few states which competently inspect and repair culverts, but they seldom give them the careful scrutiny and attention that a railway gives its corresponding structures. This is not because the road engineer overlooks the need but most often because he is at his wits end to get maintenance money enough for any purpose. That which he gets must go first where the riding public perceives the results. The more common culvert defects—choking, barrel cracks, opening joints, undermining—are seldom observable from the roadway. Their potentiality for costly damage, however, is far greater than that of a raveled surface spot. There is a wide field in highway management for developing an effective system of culvert inspection and maintenance.

State-Co-operation

A DISCUSSION of irrigation problems is scheduled to be held only a few days before the Salt Lake meeting of the American Society of Civil Engineers, at which irrigation is to be the major topic. The Secretary of the Interior and the Commissioner of Reclamation plan to speak to a meeting at Cheyenne late this month, and the circumstances of the meeting make it almost inevitable that they should address themselves to the relation of federal and state governments in the conduct of reclamation. Last winter Congress wrote into the laws the principle that federal reclamation should be aided by state co-operation—a gratifying adoption of a doctrine advanced by *Engineering News-Record* (Sept. 18, 1924, "Co-operative Reclamation"). The practical application of the principle remains to be worked out, however. In fact, chance has made it necessary to work it out in an earlier case than the specific ones contemplated by Congress in last winter's legislation. A new unit of one of the Wyoming reclamation projects, shortly ready for settlement, faces conditions that threaten to imperil the success of the whole develop-

ment unless the handicap of high cost and difficult agricultural development is reduced by obtaining competent farmers for the land and checkmating the money brokers and land speculators. In the absence of these precautions the new unit and all that settle on it may go down to ruin, as has been the case on some other parts of the project as well as in other sections of the reclamation country. To accomplish this, the co-operation of the state will be essential. If Wyoming's leaders prove to have the keenness of vision and the initiative and courage of action that the case invites, the situation can be worked out to a happy ending. In that event a new beginning may be recorded in methods of Western development. Thus, what is said and done at Cheyenne will inevitably have intimate bearing on the subject to be discussed soon after at Salt Lake.

Tar or Asphalt?

TO KNOW what a word means or what a thing is is easy until one attempts to define the word or to express the thing so that some one else cannot fail to identify it. Consider, for instance, the matter of asphalt and tar. Obviously they are two quite distinct things; there are several pages of the standard definitions of the American Society for Testing Materials devoted to their definition and to the distinction between the two. And yet we find great difficulty in reducing these definitions and those distinctions to the common understanding of even the expert. This is said feelingly because we have been seeking this simple distinction for some weeks, ever since, in fact, we inadvertently labeled as "tar" an article obviously relating to asphalt. Outside the complicated and unclear definitions referred to the best we have been able to arrive at so far is the statement by one of the leaders of highway research that "tar is a product sold by various tar companies and asphalt a product sold by various asphalt companies" and the confession by one of our leading chemists that if he were out on a road where they were putting on some black stuff the only way he would be able to tell whether it was asphalt or tar would be from the smell. And yet we suppose that most men familiar with paving work have a definite idea of the distinction between the two materials. The difficulty lies in getting their knowledge into words.

If Not On the Largest Ocean

AMONG the many reasons Los Angelenos have for self-congratulation is that the largest of the seven seas washes their shores. Years ago, the city built an outlet sewer to the Pacific. This it is now reinforcing. At the shore the city has already completed the largest assemblage of fine screens for sewage in the world. Cities close by the ocean, not yet shoestringed to Los Angeles, are either becoming tributary to the Los Angeles outfall or else building short outfalls of their own. Further inland, municipalities and areas still rural—though not for long—that have thus far refused the siren annexation calls of the city of Los Angeles have banded themselves together and bonded themselves separately, a story elsewhere in this issue tells, to construct trunk sewers, a joint outlet sewer, a shore screening plant and an ocean outfall. If Los Angeles city and county were not on the largest of our oceans their growth and visions of still larger growth would cause them anxiety until they had projected one or more ocean outlets to the largest of the seven seas.

Training Road Patrols

THE road patrolman has in his hands the popular success or failure of a highway administration. It is only lately that highway officials widely have arrived at a full realization of this fact and therefore have begun to build up the permanency and integrity of their patrolmen personnel as, for example, the railways for years have tried to perfect their section foreman and crews. So the article in this issue on lining up a highway maintenance patrol personnel is important though it relates to an activity so little spectacular as that of building up a labor force. The processes, as outlined in the article, of picking the men, of teaching them, of planning ahead with them, of advancing them by promotion, are all very simple and nowise novel in successful management. The notable fact is that they are unremittingly attended to and are bringing the reward of gratifying success. In fact there is a wealth of information in the article. Also all of it does not relate to personnel. The section on equipment and quarters has a real message for the maintenance official in the states, and there are many of them, where funds are small, precedents are few and tradition reflects all that is ineffective in public roads upkeep.

"Forget You Went to College"

NOW is the time of the year when the newspaper paragraphers like to picture the new college graduate disdainfully looking down on the rest of the ignorant world and waiting to decide which particular field of human inefficiency he will proceed to reform. This supposed attitude of mind has become traditional; it is not thought necessary to examine into it; it is one of those things that are simply so. No one who now believes it ever applies it to his earlier self or if he does and finds that he was far from being so self-sufficient when he left school, he chooses to assume that he was different from the rest of his kind, a common human failing. To rise, then, in defense of the new graduate, to assert that he is, with the usual exceptions, a modest youth who realizes quite well the deficiencies in his knowledge and more so in his experience and that his college training ought to and really does emphasize this very humility, to assert this is to place oneself in the minority. Nevertheless that contention needs a defender, particularly as regards engineering graduates, for it seems to us that the employers of such graduates are not going to make the full and best use of these young men if they continue to hold this popular view.

That they do hold it would be indicated by an investigation that has just been made by the National Industrial Conference Board and which has been reported in a release which is headed "Forget You Went to College, Is Advice to Technical Graduate Entering Industry." The board has been circularizing the so-called industries and from the executives and near executives it comes to the conclusion that the young technical graduate "is too impatient for promotion to a position of responsibility, overrates the value of his education and underrates the importance of smaller details of practice; is frequently unwilling to work long hours or to work with his hands; has little or no understanding of the practical and business aspects of the enterprise in which he is employed; and does not know how to handle himself in the presence of or in contact with

the common workmen so as to command their respect or co-operation." The trouble, as one executive puts it, with college men is "that so many of them feel that their technical education fits them far in advance of the man who has obtained his place in industry by experience." As a result of this study, the board concludes "that the degree of possible success for the majority of the technical graduates . . . depends on the willingness of the young graduate to start where all others must start in industry—at the bottom—and to meet the workmen not as a college graduate but as a man. He must, to repeat, forget for a while that he ever went to college."

We have no quarrel with the Board in its deductions. With the data presented it could hardly come to other conclusions. But, frankly, we question the data. We believe that the eminent industrialists quoted have not observed truly, or else have observed with biased minds. Their views read suspiciously like those of men who are more concerned with incoming personnel as so much immediate equipment for the factory than as personalities which may in time become the mainstay of the business. The wish to get high grade labor at low cost is very thinly veiled. Indeed the attitude here expressed may be just the reason why the manufacturing industries find, as they do, so much trouble in getting the young college man interested in their apprentice courses.

This emphatic dissent is expressed because the impression held by these men who are watching the young men coming into their plants is so different from the views one gets from traveling up and down the land talking to and with the young men in our engineering colleges today. If anything is impressed on the undergraduate in an engineering school, it is that he is not being turned out a finished engineer, that he has no reason to expect that on leaving college he is equipped to direct enterprises or govern men, but that he is learning some of the fundamentals which tied up later to practical experience will make him better equipped to do the broader thinking and the larger acting in engineering and industry. And the graduate shows the results of this doctrine. He is modest and willing to learn; he does not expect to be general manager or president right away and he knows that he needs the common touch of the laboring man before he is to be fit to direct him.

But, and this is the thing our industrialists seem unwilling to concede, he is after all, a picked man. Unless one is ready to believe—as some few iconoclasts do—that there is no virtue whatever in a technical training in a university or college, one must admit that the four years in such an institution give the young man something which he cannot get in four years in the lower ranks of industry itself. To be sure, when he leaves his theoretical training and takes up his practical training, he must enter into the lower grades; he must know how to associate with men and take his lessons from men of less theoretical education than himself, but at the same time if his college training is worth anything at all he has prepared a fertile ground in his mind wherein will grow the seeds of practical instruction much more rapidly than in the minds of those not similarly prepared.

To start off, as the industrialists reported by the Board do, with the assumption that while he thinks he knows everything he really knows less, indeed has less real capability, than the shop trained man, is to misunderstand him and therefore to treat him unfairly. These young men have the right to be treated as better prospects than the ordinary run of younger and lesser trained men and to be given the opportunity for practical learning to which their potentiality entitles them, and until the industries are disposed to consider these same men as special material they will, we believe, continue to be dissatisfied, as apparently they are now, with the reaction that the young men give to the treatment which is accorded them.

Instead of advising the young man to forget that he ever went to college we believe better advice would be to have him remember that his having gone to college imposes on him certain responsibilities and duties, not the least of which is to combat, as best he may, the too prevalent idea among the employing class that the college graduate thinks he knows it all.

Hetch Hetchy Half Done

ONE of the country's monumental water supply systems—the Hetch Hetchy project for San Francisco—has reached a milestone in its progress, so occasion is taken to recount, on another page of this issue, the status of the work to date. The mountain division has been creditably completed after a 10-year construction period, in spite of the interference that political issues and conflicting claims of contending factions have thrown around the project since its inception.

At the outset irrigationists opposed the city's filing on the water; then so called "nature lovers" vigorously fought the flooding of the reservoir site; different locations for the aqueduct were proposed and debated, contract and day-labor methods were urged and argued; the supervisors granted certain powers to the chief engineer, only to revoke them later, and last fall the work was actually closed down at a critical time by the acting mayor who disagreed with the chief engineer. Even now the Board of Supervisors is wrangling over the disposal of the power from this division, despite the fact that the date of completion of the power plant has long been known and the question has been actively before the board for three years. Most of the evils that attend political influences and the delays due to disagreements in supervisorial bodies have been present. San Francisco has never had a water board as have other large cities and there is some ground for the claim that if a good strong board had been functioning from the outset the political phases of the situation could have been more effectively handled.

All things considered, San Francisco is fortunate in having the work in such good shape at this time. The various difficulties and delays have come from somewhere outside the engineering department; at least the work has always been in the hands of loyal engineers under able direction. There are yet important decisions to be made and years of construction to be planned before this water supply can reach San Francisco. Before that time San Francisco should purchase the private distribution system and thus be relieved of the doubtful distinction of being the only large city in the United States that does not own its own water system. And by then, too, the city must settle the disposition of the power that the fall from the high Sierras makes available, but which was not contemplated at the time the first plans were drawn.

Widening the Missouri River Highway Bridge at Omaha

South Trusses Shifted and New Center Trusses Erected Under Traffic—400-Ft. Channel Span Carried by Short Trusses on Temporary Center Pier During Alterations

UNUSUALLY difficult and delicate bridge reconstruction, which was completed in 1924, was the widening of the Missouri River highway bridge between Omaha and Council Bluffs by cutting loose one truss of each span, shifting it to new piers, building a new and heavier middle truss for the double loading and then placing a new floor system and top lateral system between the new middle truss and the shifted old truss. All these alterations were made necessary by the great increase in vehicular and street car traffic and all the reconstruction work had to be done under heavy movement of automobiles and cars on the old roadway with its single-track street railway line. These conditions necessitated extreme care in placing of falsework and greatly complicated the work of renewing the floor in the old roadway. Furthermore, in altering the river span, very little falsework could be placed, both on account of the opening for navigation and the possible danger from flood, scour and drift. This span is 52 ft. above high water level.

In Fig. 1, the south truss of the channel spans is shown cut away and moved 8 ft. from its original position, with the separated ends of the laterals supported by shoring and those of the floorbeams suspended from temporary trusses. Figs. 2 and 3 show the general arrangement of work on this span. Fig. 4 shows the portal of the completed span, widened to double its original width.

This bridge as built in 1888 had a through-truss channel span of 400 ft., of the double-intersection Pratt truss type, with six deck truss spans of 150 and 250 ft. forming the east approach. The 1,264-ft. west approach was a viaduct composed mainly of 75-ft. deck truss spans between 25 ft. tower spans, with two through truss spans of 100 and 150 ft. and a deck-truss flanking span of 175 ft. In the reconstruction of the approaches the only change from the original arrangement was that in the west approach some of the trusses were replaced with girder spans and the 175-ft. deck truss span was rebuilt entirely. Instead of a 24-ft. roadway with one car track, the channel span now has two 24-ft. roadways and two tracks 14 ft. c. to c.; the old 6-ft. sidewalk carried on cantilever floorbeams outside the north truss remains unaltered. On the deck approaches, the old 24-ft. roadway is widened to 40 ft., with two tracks 10 ft. c. to c. and the old 6-ft. cantilever sidewalk is retained. New foundations for the river spans consist of concrete piers in steel shells (Fig. 2), while pedestal footings carry the additional work on the approaches.

Altering the Channel Span—To support the old floorbeams and enable the south truss to be cut away from them, two temporary steel 175-ft. trusses were erected on the roadway or north side of that truss as shown in Figs. 2 and 3. These half-span temporary trusses were supported at the middle of the main span by a temporary center pier of heavy timber framing, protected from drift and scour by steel sheetpiling, the enclosed space being filled with sand. The east end of one truss rested on the pier of the main span; the west end of the other truss rested on falsework supported by piling driven in the river bank. Each floorbeam was then carried by four 1¼-in. rods suspended from saddles over the top chords of the 175-ft. trusses. This falsework

FIG. 1—WIDENING MISSOURI RIVER BRIDGE AT OMAHA
South truss 8 ft. from original position. Top laterals on shoring. Floorbeams suspended from temporary trusses.

arrangement in the span while the changes were being made is shown in Figs. 3 and 5.

With these temporary trusses erected, knee braces were placed against the north (unmoved) truss at panel points U-1 and U-8. The portals were strutted and braced to the floor with 8x16-in. timbers and temporary diagonal bracing and timber top laterals were placed in each panel. Timbers 40 ft. long and varying from 8x8-in. to 10x12-in. section were placed at panel points just under the top chord so as to clear the diagonals of the new and old trusses. These timbers were rigidly fastened to the north truss and the south truss was connected to them by push-and-pull ratchet jacks of 10 tons capacity. After this bracing was all in place the rivets in the floorbeam connections were cut out and the pins which connected the top struts to the south truss were removed, thus freeing the south truss from the rest of the bridge.

At the east end of the span a runway of rails for shifting the truss was constructed on girders between the middle pier and the new south pier, the north end of the girders being supported on falsework and the south end by rod hangers suspended from a saddle over the new pier, as shown in Fig. 2. At the west end, falsework was built up from the ground. The truss was placed on rollers and moved by jacks placed horizontally against the shoes. As the shoes were moved, the ratchet jacks which were connected to the top and bottom chords were operated so as to keep the truss

lined up and in a vertical position. The truss was moved three inches at a time so as to insure a uniform movement at all points.

After the old truss had been moved 8 ft. south from its original position, two 20-in. I-beams, which were afterwards used as stringers for the street-car track, were suspended from the south truss and old floorbeams at each panel point. These beams carried the weight of the new truss during erection and also carried a service track placed between the old south truss and the new truss. After the new truss was erected, the portals, top laterals and top and intermediate struts were placed in the north half of the span; then the old south truss was moved 20 ft. farther to its permanent position. It took four hours to move the south truss the first 8 ft. and 6 hr. 10 min. to move it the last 20 ft., the total movement being 28 ft. The weight of the old 400-ft. truss which was moved is 170 tons; that of the new center truss is 500 tons.

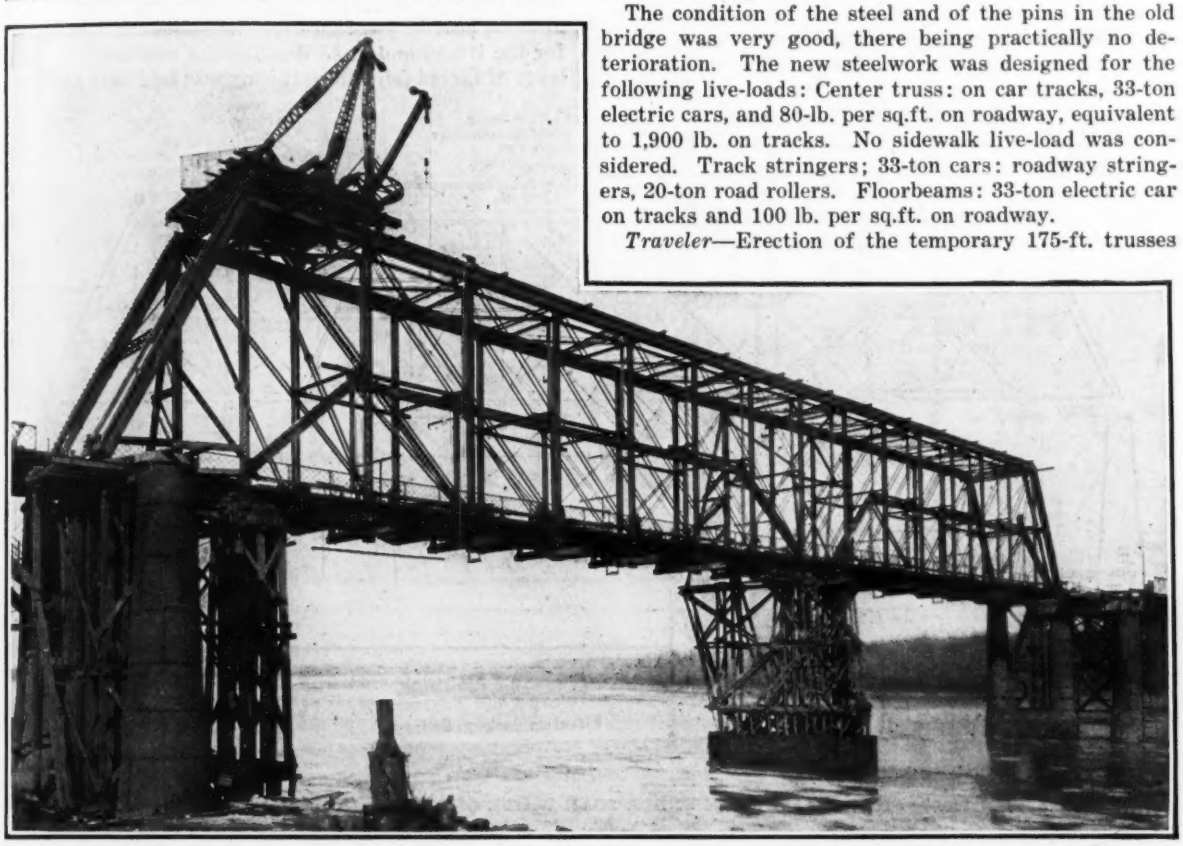


FIG. 2—400-FT. SPAN OF MISSOURI RIVER BRIDGE
Temporary 175-ft. trusses and center pier support falsework carrying top laterals. Hangers from temporary trusses carry ends of severed floorbeams. South (right) truss ready to be shifted to new piers.

Handling the 175-ft. Trusses—In erecting the two 175-ft. trusses which were used to support the south end of the old floorbeams, the material was hauled in on a truck and erected on the bridge floor. It was necessary to move the street-car track north about 5 ft. from its original position in order to make room for these new trusses, which were erected 4 ft. north of the old south truss. After the new 400-ft. middle truss was erected and the floorbeams were connected to it, the 175-ft. trusses were loaded on two trucks with A-frame towers and flanged wheels and were hauled over the street-car track to the west end of the 400-ft. span. There a derrick car and a locomotive crane lowered them to their final positions under the bridge floor for the new west flanking span. Fig. 6 shows this operation, with the towers in place carrying the 175-ft. span and the hoisting machinery in place on the tracks below. One truss weighed 55 tons and the other 35 tons.

The condition of the steel and of the pins in the old bridge was very good, there being practically no deterioration. The new steelwork was designed for the following live-loads: Center truss: on car tracks, 33-ton electric cars, and 80-lb. per sq.ft. on roadway, equivalent to 1,900 lb. on tracks. No sidewalk live-load was considered. Track stringers; 33-ton cars: roadway stringers, 20-ton road rollers. Floorbeams: 33-ton electric car on tracks and 100 lb. per sq.ft. on roadway.

Traveler—Erection of the temporary 175-ft. trusses and new middle truss of the 400-ft. span was done by a traveler riding on the top chord of the span, as shown in Figs. 2 and 7. It carried a 15-ton steel stiff-leg derrick with 40-ft. boom and was equipped with a three-drum electric hoist having a line pull of 5,000 lb.; current was supplied by the electric railway. Sills 40 ft. long were mounted on grooved wheels riding on rails spiked to timber stringers on the top chords of the old trusses. When the south truss was to be moved, that end of the traveler frame was shored up from the floor and its south truck frames were disconnected from the traveler and anchored to the truss. After the truss had been shifted 8 ft. the truck frames were again connected to the traveler. In this position the traveler erected material for the new middle truss. With this truss completed, the trucks and derrick frame were moved back 8 ft. to the original position, leaving the south truss free for its final move. In this position the traveler then handled material for the reinforcement of the floor system

East Deck-Truss Spans—In moving out the south trusses on the east approach, the same program was followed, except that piles were driven in the river at every panel point and the south ends of the floorbeams were supported on falsework. For each span the old

south truss was then cut loose from the floor system and moved about 3 ft. 6 in. south from its original position. The new center truss was then erected, the top chords being raised first and fastened to the floor-beams. After the new center truss was erected and the

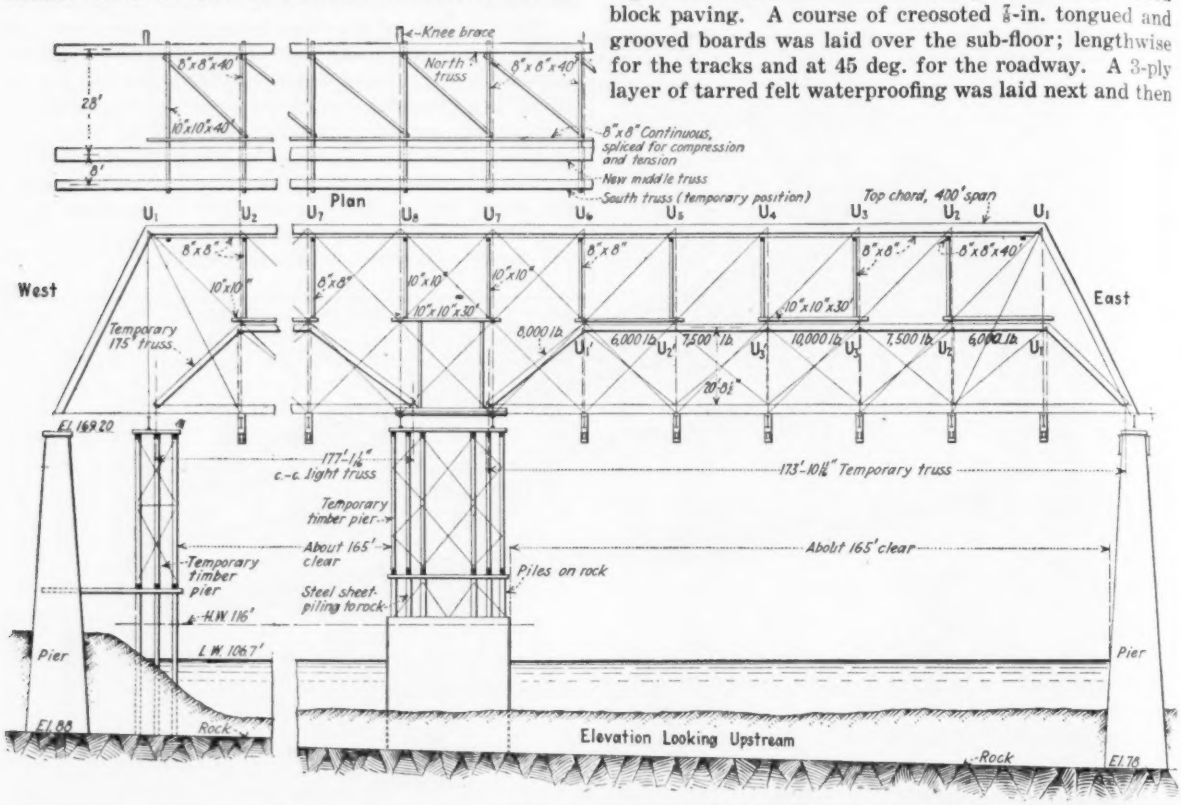


FIG. 3—FALSEWORK UNDER SPAN WHILE ONE TRUSS IS MOVED

permanent bracing between it and the north truss was put in place, the south truss was moved to its final position and the new laterals and bracing connecting it to the middle truss were installed. Each of the old deck trusses moved weighed 65 tons. The time for moving one truss varied from two to four hours. In the floor system, the old 10-in. joists were replaced by 12-in. I-beams to provide for the increased loading. The paving is of wood blocks on a plank sub-flooring, as described below.

Shifting the West Approach—Owing to the fact that the west approach is over Douglas St., one of the principal streets of Omaha, the center line of the structure coincided with the center line of the street. As all the additional width was made on the south side of the old bridge, this arrangement made it necessary to move the approach north 7 ft. 10½ in. in order to keep the new center line of the widened bridge on the center line of the street. Accordingly the approach was jacked up, placed on railroad rails and then jacked laterally to a position 7 ft. 10½ in. north of its original position. Falsework was then placed under the various spans, new columns and new center trusses were erected and the old trusses were moved south to their final positions.

Floor System on Approaches—Floorbeams on the top chords of the deck spans of the approaches carry longitudinal lines of I-beam stringers on which was laid a course of transverse creosoted sub-floor timbers, 4¾-in. thick under the roadway and 5¾-in. thick under the car tracks. These timbers were wedged tightly together before being bolted to the stringers and this bolting was done very thoroughly to prevent the sub-floor from moving if there should be excessive expansion of the wood block paving. A course of creosoted ⅞-in. tongued and grooved boards was laid over the sub-floor; lengthwise for the tracks and at 45 deg. for the roadway. A 3-ply layer of tarred felt waterproofing was laid next and then the 3½-in. creosoted lug-block paving. This typical construction is shown in Fig. 7. Similar paving was used on the channel span, where the old 10-in. joists were replaced with 12-in. I-beams on account of the heavier loading.

For the car tracks, 85-lb. rails of A.S.C.E., section, fastened with screw spikes, were laid on steel tie-plates

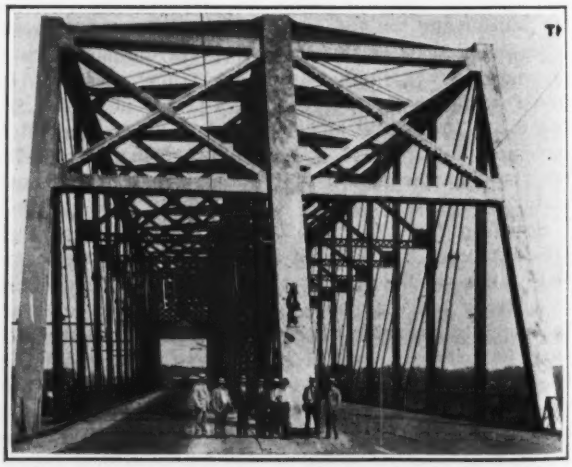


FIG. 4—PORTAL OF OMAHA BRIDGE
Center truss is new. Old south truss moved 28 ft. to right. North truss, at left, unchanged.

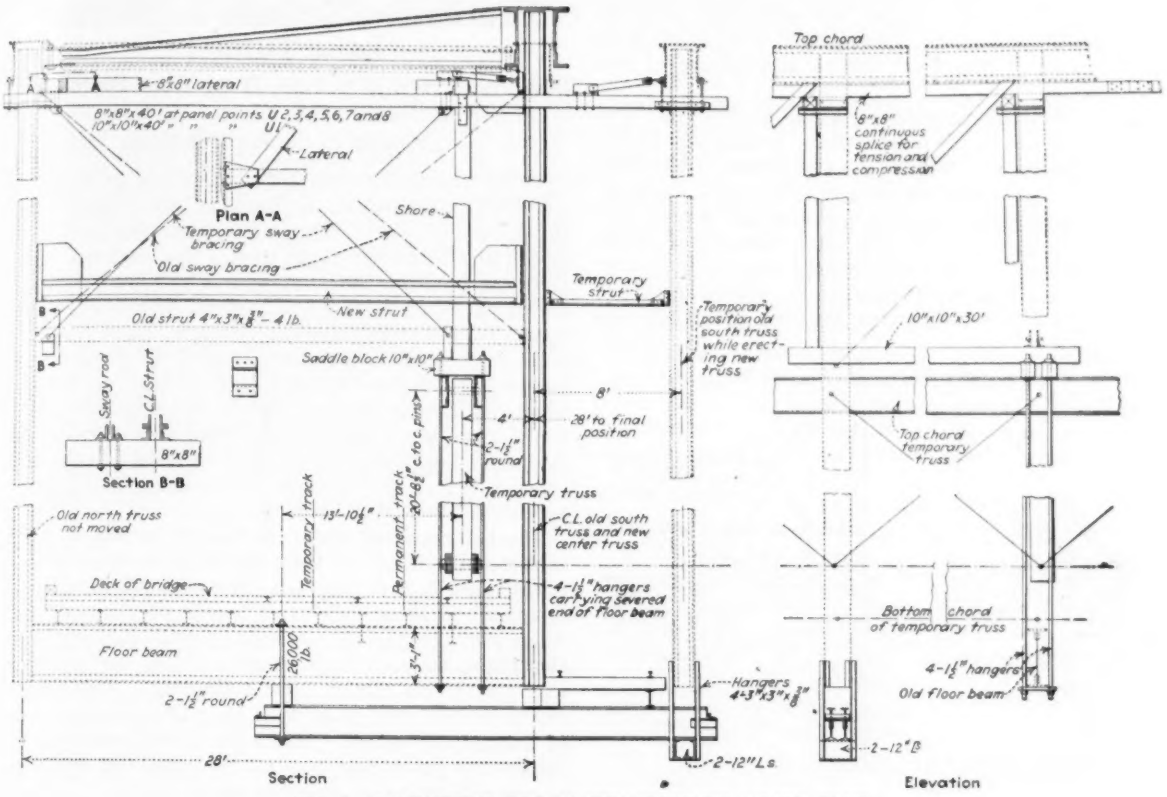


FIG. 5—FALSEWORK FOR ALTERATIONS TO 400-FT. SPAN

on the sub-floor which was dapped for these plates in order to bring the rails level with the paving. Asphalt mastic was filled in around the base of the rails and the wood paving was grooved for the flangeways. Since the bridge company had had previous trouble with the curb being thrown out of line by expansion of the wood block paving, a 1-in. expansion joint of mastic was provided between the blocks and the curb. In addition, 4-in. transverse slots were cut in the 8x8-in. curb timber and in bolting the timber down the bolt was placed at the outside end of the slot, so that the curb could move out without pulling on the sub-floor timbers.

In the reconstruction work the old floorbeams were strengthened by top and bottom cover plates, and extended by splicing a new piece to reach the new position of the south truss. On this extension, the new stringers were laid. The new floor was put down in three longitudinal sections; south, center and north. As the old car track had been on the south side of the roadway it came on the new center section. A temporary track was laid on the sub-floor of the new south section and the cars were diverted while the new floor system and sub-floor were placed in the center section. During this time, vehicle traffic remained on the north section or old roadway. The new south track was then laid on the center section and cars were diverted to it. Then the

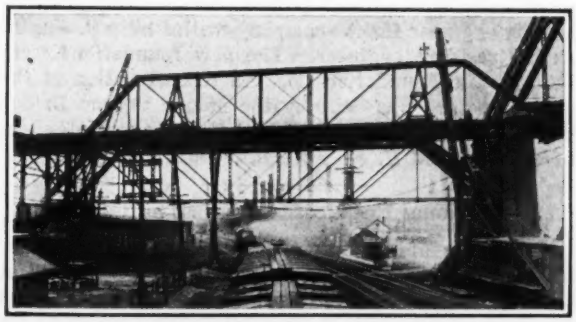


FIG. 6—PLACING NEW 175-FT. DECK SPAN

Span carried by timber towers with trucks riding on street car track. Locomotive crane and derrick car ready to lower it to replace old deck span. Channel span at right; viaduct approach at left.

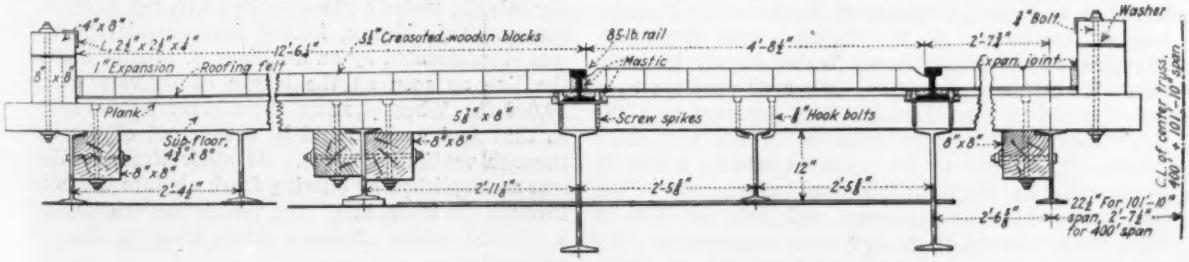


FIG. 7—TYPICAL FLOOR CONSTRUCTION ON BRIDGE AND APPROACHES

paving of the south section was completed so that vehicles could use it and thus allow of proceeding with the renewals of the floor system and paving of the north section.

This series of operations in changing the floor was done four times in the length of the bridge, due to the extended period required for the completion of the erection work. These sections were of fair length, however, as the bridge is about a half a mile long and the resident engineer states that although many changes of street car and vehicle traffic were required they were carried out with comparative smoothness and without accident, due to the close co-operation between the track and

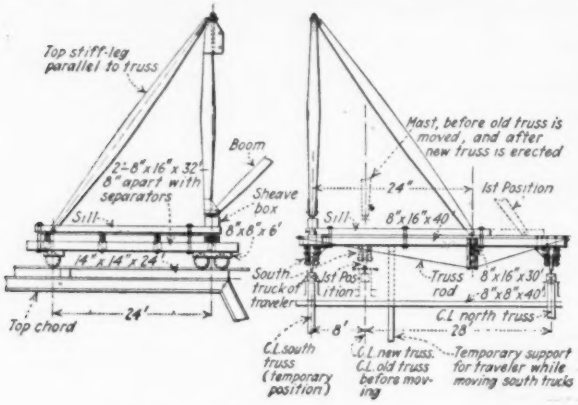


FIG. 8—TRAVELER ON OMAHA BRIDGE

operating departments of the street railway and the contractor's forces.

This Missouri River bridge is owned by the Omaha & Council Bluffs Railway & Bridge Co., and the enlargement was planned by Ralph Modjeski, Chicago, as consulting engineer for the company, with Philip P. Angier as his resident engineer. The new foundations were built by the Foundation Co. All reconstruction of the superstructure was done by the Mount Vernon Bridge Co., Mt. Vernon, Ohio, with N. Lytle as superintendent of erection and F. E. Withgott, engineer.

Professional Engineers Organize by Counties

County organizations of professional engineers are being formed in New Jersey, under the auspices and at the suggestion of the State Association of Professional Engineers, in order to form effective working units for applying and strengthening the state license law and dealing with related professional problems. On June 10 the Essex County chapter was organized, with W. A. Stickel, county engineer of Essex County, as president. Addresses on the purposes of organization were made by S. W. McClave, president of the state association, Dr. D. B. Steinman, president of the American Association of Engineers, A. M. Knowles, and Morris R. Sherrerd, of the North Jersey Water Supply Commission. With this organization, 12 county chapters have been formed in New Jersey. It is expected that the other counties will form chapters in the immediate future. Assistance to the state examining board in interpreting the licensing law, local enforcement of the law, co-operation of engineers, and determination of what improvements of the law or of engineering practice may be necessary, are among the prominent objectives of the county chapter plan.

Ventilation Methods in Florence Lake Tunnel

Heading Driven 19,000 Ft. from West Portal—Air Held Gases after Blast—Excessive Friction in Corrugated Pipe

THE recently completed 13½-mile Florence Lake tunnel of the Southern California Edison Co. involved the driving of several tangents in which unusually long ventilating pipes had to be used. The heading driven from camp 60 at the west portal had been advanced 19,000 ft. when it met the heading driven an almost equal distance from camp 61. Factors that were found to be important in the ventilation of tangents of this length were the use of auxiliary blowers as boosters when the lines exceeded 10,000 ft. in length, the use of a curtain of small jets of compressed air to retain powder gases near the heading until the foul air could be exhausted, and the improvement in size of cartridges and materials used in blasting.

The net result of these improvements was that the exhaustion of foul air from the heading was effected, toward the end of the job, in about 35 minutes as compared to about twice this length of time required when the job started. A wait of half an hour after blasting was always insisted upon, before any employee was allowed to return to the heading. This was a safety measure to make sure that there was no risk of delayed explosions. Hence the period required for exhausting gases was reduced as much as would be of any advantage in speeding up the work.

Ventilation—Three types of ventilating pipe were used, all 24 in. in diameter: (1) Wood-stave, (2) corrugated iron lined with sheet metal and (3) plain 12-gage steel pipe.

The difficulty with the wood-stave pipe line was that the staves would dry out, the joints would open and leakage would result. To remedy this a ½-in. water pipe was thrust into the line here and there where leakage was bad and a water spray was used to keep the staves swelled to a tight fit. A considerable amount of corrugated pipe was used for ventilation, this type being expected to have strength to resist collapsing and to withstand rough usage. Tests on this pipe (reported in brief at the end of this article), however, showed friction losses so excessive that it was considered worth while to insert 22-gage smooth liners and rivet these to the 16-gage pipe. The lining was occasionally jarred loose either by concussion from a heading blast or as a result of rock falling on the pipe. When this occurred the lining would be likely to block the line. All things considered, the preference was for the plain steel pipes.

Draft through the 24-in. line was provided by a blower with a rated capacity of 10,000 cu.ft. of free air per minute, under a pressure of 1½ lb. per sq.in. at the blower. This blower, located just outside the portal, was supplemented by an auxiliary or booster blower in the line as soon as the length of delivery exceeded 10,000 ft. When blasting, these blowers were reversed so that foul gases would be drawn out of the tunnel through ventilating pipes. At other times ventilation was accomplished by blowing fresh air into the heading through the 24-in. line. The ventilating system showed a slightly better efficiency when blowing than when exhausting.

The end of the ventilating pipe was kept 250 to 300 ft.

back from the heading when blasting and in this position was rarely damaged by flying rock. A grillage of iron bars was kept over the end of the pipe as a protection against fragments that might be thrown that far.

TESTING PARALLEL LINES OF WOOD AND CORRUGATED IRON VENT PIPE

Air Curtain—The air curtain consisted of jets of compressed air from a 1-in. pipe on the bottom of the tunnel, extending entirely across the floor about 75 ft. back from the end of the ventilating pipe. The 1-in. pipe was tapped into the 6-in. compressed air line, carried into the tunnel to serve drills and mucking machine. In the 1-in. pipe were ⅛-in. holes about 4 in. apart drilled so that air jets would be directed toward the heading and at an angle of about 45 deg. with the tunnel's center line. The combined effect of this curtain and the suction of air into the end of the ventilating pipe was a very rapid exhaustion of foul air.

The first operation after the men returned to the heading was to spray the face and the muck pile with water. This cleared up any foul air pockets that might remain, aided in laying the dust and facilitated examination to see if there were any traces of missed shots.

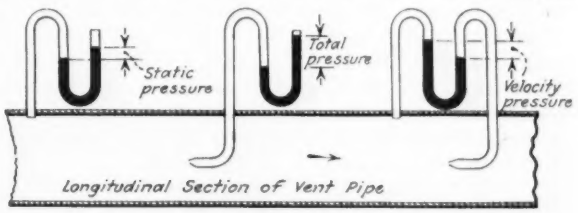
The ventilating problems were considerably simplified by the use of the 1½x12-in. and 1¾x12-in. sticks of 40 and 60 per cent dynamite instead of the ordinary smaller size because in these larger sizes less paper was required for a given amount of explosive. Some 2x12-in. sticks were also tried and this size would have been used more extensively were it not that with this diameter there was some tendency to jam in the drill holes. An improvement, recently made by the powder manufacturers, which still further simplifies the ventilation problem was a new combination of chemicals in explosive and paper such that the new proportions give much less C O than formerly resulted from the explosion. Another advantage of using the large size cartridges is that these cut in half the time required to charge the drill holes.

The blasting practice in this tunnel was to make two heading blasts to one bench shot. After experiment with holes of depths ranging up to 15 ft. in the heading the maximum length of drill steel was standardized at 9 and 11 ft. using 38 to 42 holes according to conditions. In the bench the best length of steel was found to be 21 to 25 ft. and here 12 to 15 holes were ordinarily used. With this combination the ordinary blast in a heading used 450 lb. of powder and the ordinary bench blast required 250 lb. The choice of 40 and 60 per cent powder in both heading and bench was determined by the character of rock. In holes exceeding 17 ft. in length and in order to secure a desirable distribution of the powder, dummies of wood were alternated with cartridges.

Tests were made to determine the friction loss and carrying capacity of corrugated iron pipe and wood-stave pipe under conditions similar to those in tunnel operations. For this purpose two lines of pipe were laid side by side on the dump at camp 61, one of the lines being wood-stave pipe and the other corrugated iron pipe. Both types were provided with the standard connections commonly used in western practice and were standard in all particulars. Each line was 760 ft. long and at the blower end terminated in smooth iron fittings arranged so that either line could be connected to a standard No. 7 blower driven by a 100-hp., 440-volt induction motor.

Beginning 50 ft. from the center line of the blower and uniformly thereafter 100 ft. apart to the end of the lines, test holes were drilled in each pipe for the insertion of pitot tubes to be used in taking measurements. The blower was discharged through each pipe successively and readings were taken of the power input to the motor, speed of the blower, static pressures, velocity pressures and wet and dry bulb temperatures of the air. A barometer was not available but the pressure was assumed as 22.9 in. of mercury, the nominal value for El. 7,000 ft., the elevation of this camp.

Static pressures were taken by means of a water column U-tube and an L-shaped piece of copper tubing



PITOT TUBES ARRANGED TO SHOW STATIC VELOCITY AND TOTAL PRESSURES

with the sealed end pointed against the direction of flow and having small pressure holes drilled about 2 in. from the sealed end.

Determination of the horsepower imparted to the air in each pipe was made by the following formula:

$$Hp. = \frac{Vol.\ cu.ft./min. \times press.\ (lb./sq.ft.)}{33{,}000}$$

Applying this formula to readings made on the corrugated iron pipe gave 22.1 hp. and corresponding value for the wood pipe gave 5.6 hp. In other words, for the same quantity of air transmitted in both pipes the horsepower input in the case of the corrugated pipe was 3.95 times as great as the input to the air in the wooden pipe.

A determination of the coefficient of friction for each pipe was made by the following formula:

$$P = \frac{fl}{D} \times \frac{V^2}{2g}$$

where P is in lb. per sq.in.

l is the length of pipe in feet.

D is diameter of pipe in inches.

V is velocity in ft. per-second.

g is acceleration of gravity.

For the iron pipe this formula gave a value of f equal to 0.000378 and for wood pipe f equaled 0.0000852; that is, the friction in the corrugated iron pipe was 4.44 times as much as in the wood-stave pipe.

Calculations to show the size of corrugated iron pipe necessary to carry the same amount of air as the wood pipe with the same friction loss showed that a 24-in. wood-stave pipe corresponded in these particulars to a corrugated iron pipe 32.32 in. in diameter.

A description of construction methods on the Florence Lake tunnel appeared in *Engineering News-Record* May 3, 1923, p. 776, and details and progress were described Dec. 20, 1923, p. 1021, June 5, 1924, p. 992, and Dec. 25, 1924, p. 1050.

Florence Lake tunnel has been driven by the Southern California Edison Company's own forces. E. R. Davis, manager of construction, D. H. Redinger, resident engineer, H. A. Kruger, superintendent in charge of Florence Lake project, assisted by E. C. Panton in charge of concrete work, and F. T. Huntington in charge of tunnel construction.

Maintaining Compressed-Air Lines 19,000 Ft. Long

Florence Lake Tunnel Experience Suggests 8-In. Pipe and Receivers 2,000 to 3,000 Ft. Apart —Three Compressor Sizes Enough

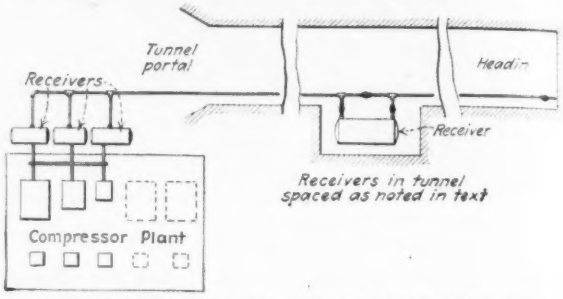
IN DRIVING the long tangent of the Florence Lake tunnel, the Southern California Edison Co. had occasion to supply compressed air to drills and mucking machines at distances ranging up to 19,000 ft. from the compressor. Since this tunnel as a whole is 13½ miles long and has a section of 15x15 ft., experience in maintaining the air supply on this job had to do with the delivery of air in large quantities and extended over a period of several years. Some features of the compressed-air system and conclusions based on experience in its operation are noted in the following.

In order to maintain a pressure of at least 90 lb. per sq.in. at the ends of long delivery lines, a pressure of 115 lb. was developed at the compressors. The greatest demand on the air system occurred when nine drills were operating at the face (four in the heading and five on the bench), and concrete was being placed elsewhere in the tunnel by pneumatic gun. This required more air than when the four drills were working in the heading and the air shovel was working at the face of the bench. The air shovel used about 1,000 cu.ft. of air per minute during normal operation. The concrete gun used about 2,000 cu.ft. per minute for deliveries under 500 ft. As delivery lines of greater length were used the quantity of air consumed increased rapidly, the demand approaching 3,000 cu.ft. as the delivery distances increased toward 1,500 ft.

At the outset a 4-in. main was used to convey air from the compressors at the portal of the heading. Friction losses in this line were such that the 90-lb. pressure desired could no longer be satisfactorily maintained at the working face when the delivery line had reached a length of 5,000 ft. Thereupon the old 4-in. line was used for drainage and a new 6-in. line was put in for air delivery. From that time on this 6-in. line was used all the way from compressor to the heading in all long runs. Nine receivers, 4½x12 ft. in size, were used on the 19,000-ft. line.

The practice was to put two T-connections on the 6-in. line at the points where receivers were to be later installed. Thus the receivers could be set up without interference with air pressure and could be cut in by the opening of the valves. In practice it was found desirable to close the valve in the main line opposite the receiver and thus to route the air through the receiver which gave a better opportunity for drainage.

Recommendations — Based on experience gained in driving this tunnel the engineers in charge reached the conclusion that in work of this character it would be preferable to decide at the outset upon one make of



ARRANGEMENT OF COMPRESSORS AND RECEIVERS

compressor, make it standard throughout the job, and then to use only three sizes of that one make. This would make possible a highly desirable standardization of parts and would still allow a sufficient flexibility so that installation of the capacities necessary could be made with the standard sizes.

The compressor sizes considered desirable are (1) 17x10x14 in. with capacity of about 550 cu.ft. at 7,000-ft. altitude; (2) 22x13x16 in. with capacity of about 1,100 cu.ft., and (3) 28x17x21 in., with capacity of about 2,000 cu.ft. Variable load requirements can be well taken care of with these combinations, with compressors located at the tunnel portal. For the first year's work the recommendation is for compressor capacity amounting to 3,500 cu.ft. This allows leeway for a considerable amount of repair work. Thereafter compressor capacity should be added each year up to a maximum of 6,000 cu.ft. for two portals, each serving lines 15,000 ft. or more in length.

In selecting sizes of delivery lines, experience on this job would suggest that if distances as great as 15,000 ft. are to be served it would be advisable to use an 8-in. main for the first mile and 6-in. thereafter.

With respect to receivers it is recommended that in addition to the receivers needed for proper storage at the compressor plant, the first receiver should be placed on the main line about 1,000 ft. from the compressor and that thereafter a spacing of two to three thousand feet is the economical figure. The shorter distance in the first length is because oil and water of condensation cannot be entirely drained off at a point near the compressor. At a distance of 1,000 ft. out on the line the pulsation and agitation is enough less to materially improve the drainage.

Gasoline Tax Aids Road Construction in Mexico

Effective April 1, a tax of 3 centavos (about 1½ cents) per liter is being levied on the domestic consumption of gasoline in Mexico. The proceeds, which it is said will amount to about 4,000,000 pesos (about $2,000,000) yearly, are to be devoted to road building.

Lining Up a Highway Maintenance Patrol Personnel

Selecting Patrolmen—Equipment and Quarters—Instructing Patrolmen—Logging of Required Improvements

By H. J. Friedman
Maintenance Engineer, Savannah Division, State Highway Department of Georgia, Savannah, Ga.

FOR maintenance, the state highways in Georgia are divided into patrol sections. The average section is manned by a crew consisting of a patrolman in charge and a force of four men. The success of a maintenance program depends largely on the patrolman. The following are considered the most important factors in the development of the patrolman personnel to a state of efficiency: (1) Careful selection of patrolmen; (2) adequate equipment and quarters; (3) proper instruction.

The methods here described for carrying into effect these requirements are in use in the Savannah Division of the Georgia highway department.

Selection of Patrolmen—When beginning the maintenance organization, it was necessary to secure the best available material from men whose experience adapted them to this new phase of highway work. Patrolmen were as a rule selected for their mechanical ability and later trained in road work. The success of the program depending largely on keeping the equipment going and in good condition, this policy was considered better than to pick men with road experience and train them in the care and operation of equipment. As the work differed from the usual road work, considerable instruction was necessary to fit even an experienced man in his duties, and if it was necessary also to train him regarding all mechanical lines, there was a strong possibility that the equipment would suffer.

The patrolmen first selected were chosen with extreme care as to their character, and ability, but particularly their "stickability." This policy has been justified. Over a period of three years' operation, there has been practically no turnover. There have of course been changes due to transfers and to promotion.

The machinemen and truck drivers are also carefully picked with the idea that they could qualify for advancement. The number of patrol sections has been practically doubled in the past three years and all patrolmen for the new sections have been selected by promotion from among the machinemen and truck drivers.

A policy of filling all positions from supervisor, mechanic, and patrolman down, by promoting within the organization has been in effect. This has been made advisable by the fixed salary limits placed on the various jobs. The organization has been so developed that it is now very seldom that a man above the grade of laborer is hired from the outside.

Equipment and Quarters—Proper equipment is so largely a matter of local conditions that it is hardly advisable to attempt to go into detail in this regard. Carefully kept data have however shown that in most cases equipment with the highest initial cost proved the most economical and satisfactory in operation. This applies in general to everything from a shovel to a 10-ton tractor.

One of the important factors in efficient operation is the providing of proper headquarters for storing and repairing tools and equipment. It has been found that a well constructed shed 20x30 ft. affords sufficient space for storing a 5-ton tractor, a truck and small tools, in addition to a work bench, oil racks, etc.

By building the quarters with windows and large double doors, proper light and ventilation are secured, so that equipment can be overhauled and repaired indoors and the patrolman and his crew can keep busy in bad weather. The time is well spent and the men are better satisfied than if they were compelled to lay off when weather conditions do not permit outside work.

If the highway department were to build these quarters, it would be necessary to acquire or lease land for them and thereby a considerable loss of time and expenditure of money would be entailed. By explaining to the local authorities the advantages in the way of better roads and increased local payroll of having a patrol section headquarters located in their community, the towns have been glad to erect a quarters in accordance with our requirements; it is usually located at some point on town or county property that fronts on the state highway.

Instructing Patrolmen—Instructions are: (1) General, aiming at standardizing his work; (2) instructions dealing directly with the details of his particular work.

The patrolmen are so widely distributed that it is almost impossible to gather them for educational instruction; and for detailed instructions regarding their work it is seldom that they are visited by the supervisor or other persons in charge oftener than twice a week; further, these visits are usually short in duration, due to the ground which the supervisor must cover.

General Instructions—Each patrolman is supplied with a book of standards, fifteen in number, of letter size, simply gotten up and covering such features as roadway and surfacing sections, methods for installing different types of culverts, placing riprap, sodding slopes, constructing bulkheads, etc. The patrolman is expected to familiarize himself with these standards, but is impressed with the fact that he is not expected to follow them explicitly but that they are to be used more as a guide and for working toward uniform methods throughout the different sections.

These standards are supplemented by circulars sent out whenever an exceptionally good method of handling any phase of the work is hit upon, or when any general practice that appears harmful demands correction.

Each patrolman is supplied with instruction books covering the care and operation of the different items of major equipment in his charge, such as tractors, trucks and road graders. These instruction books are issued by the different manufacturers and are practically all simply and well written and illustrated.

These features are of course supplementary to the verbal instructions and explanations of the maintenance engineer, supervisor, and mechanic on their rounds over the patrol sections.

Detailed Instructions—The patrolman receives his orders from the maintenance engineer and the supervisor. In order that no question may arise, the detailed instructions are given by the supervisor and confirmed in writing in the following manner:

At the beginning of the season the supervisor goes over each section with the patrolman and outlines to

him in detail the work to be done. Each point is thoroughly discussed on the ground; the patrolman is encouraged to express his views, though they may be contrary to those of the supervisor. When a solution has been agreed upon, the supervisor makes a brief note of his orders on the point in a log book. For each section a log book is provided. It usually takes two days to log a forty-mile section. The work shown on the log is intended to be completed within a four-month period, so that usually each section is logged three times a year.

The supervisor turns the log book over to the maintenance engineer, who discusses with him the outlined work, approves the log, and has five typewritten copies made. The original goes to the patrolman, one copy each to the state highway engineer, the division maintenance engineer and the supervisor, and one to the files.

A typical log covering one state route forming a portion of a maintenance section is shown, the mile post locations are secured by the use of the speedometer:

ROAD LOG

Location—Section No. 6.
Headquarters—Swainsboro.
Logged by W. Branan, Supervisor, and J. L. Curl, Patrolman, June 18, 1924.

ROUTE 26—SWAINSBORO WEST

Mile Post		Mile Post	
0.0	Court house, Swainsboro.	7.2	Brush out curve.
0.9	Build up shoulders on right and re-clay.	8.1	Baffle ditch on right.
1.0	City limits, Swainsboro.	10.3	Dig surface ditch on upper side of cut.
1.1	Cut ditch right and left.	12.2	Central of Georgia R.R. crossing (1 track).
2.4	Brush out curve and cut back trees.	13.1	Repair timber bridge. Required: 10 pieces 3x8 in. x16 ft., four pieces 3x12 in.x14 ft.
2.9	Place 18-in. corrugated iron culvert 32 ft. long.	13.8	Log up washed filled for 150 ft. and rebuild shoulder with clay.
3.4	Raise fill 12 in. for 300 ft. and re-clay.	14.3	Soil shoulders of fill.
3.6	142 ft. concrete bridge O.K.	1.6	Ohoopee River bridge—Concrete 662 ft. long Johnston-Emanuel County Line.
4.2	Widen fill 4 ft. for 600 ft., cut back trees, brush out curve on left.		End of Section.
4.9	Lengthen out 24 in. corrugated iron culvert 6 ft. and build log headwall.		
6.9	Resurface fill for 960 ft.		

As is seen, the outlined work does not cover such features as dragging, filling washouts, and emergency work. Such tasks are considered routine, though of ranking importance and to take precedence over all other work. It is after work of this character is completed that the patrolman is expected to take up the work outlined in his log. In order that the patrolman may develop initiative, the supervisor makes no attempt to dictate just what is to be done on each day. He simply indicates to the patrolman the points on the log which should be taken up next. As the patrolman completes an item shown on his log, he makes a notation as a matter of record of the date on which the work was done.

The results from the logging method have been good. The central office is kept informed as to the detailed field work, the maintenance engineer has a check on the supervisor, there is no room for dispute as to whether or not an order has been given, the supervisor is kept in close touch with the progress of the work, and the patrolman has a clear view of a several months' progress ahead of him.

To secure efficient work from the patrolman under this scheme requires unceasing vigilance and labor on the part of the maintenance engineer and supervisor, but it has been found that better results are secured than with no definite policy other than verbal instructions to patrolmen.

Suggests One-Day Strength Test For Concrete Aggregate

Quick Hardening Alumina Cement Gives Results Comparable to Same Sands Tested with Slower Setting Portlands

By Searcy B. Slack and J. E. Boyd
Bridge Engineer and Testing Engineer, Respectively, State Highway Department of Georgia, East Point, Ga.

ONE OF the serious drawbacks to the present method of testing fine and coarse aggregates as materials for concrete is the time required for the tests. Positive results cannot be obtained in less than 28 days. The 7-day test is generally regarded as an indicator only, for too many factors, other than the strength of the aggregates to be tested, may seriously affect this short-time test. In many cases a 28-day delay for tests is serious and the need has long been felt for a quicker test from which positive results could be expected.

The purpose of this article is to suggest a method giving a real test of strength of concrete aggregates in 24 hours. The test is based upon the use of high alumina, or other, cement, which will develop within 24 hours a strength equal to or greater than the strength developed by ordinary portland cement in 28 days. The commercial production of such cement in the United States makes the test practical for all laboratories.

Tensile Tests—Comparative tests of several samples of sand have been made using the test for fine aggregates as outlined by the American Society for Testing Materials and at the same time making up briquets with alumina cement. Briquets of ordinary portland cement, standard Ottawa sand and the sand to be tested were made in accordance with usual practice. At the same time briquets of alumina cement and standard Ottawa sand and of alumina cement and the sand to be tested were made. All briquets were of 1:3 mortar. Each sample of sand was tested separately. The results are shown in the accompanying table.

TABLE SHOWING COMPARISON OF PORTLAND CEMENT (28 DAYS) AND ALUMINA CEMENT (24 HR.) FOR SAME SAND

Values are average of tension briquet in lb. per sq.in.

Sand	Alumina	Portland	Ratio Sample Sand to Ottawa
Ottawa	...	347	86.7
Willio	...	301	...
Ottawa	395	...	85.3
Willio	337	...	...
Ottawa	...	377	112.7
Chehaw	...	425	...
Ottawa	396	...	110.3
Chehaw	437	...	...
Ottawa	...	335	112.2
Gaillard	...	376	...
Ottawa	390	...	116.9
Gaillard	456	...	...
Ottawa	...	362	119.1
Montgomery	...	429	...
Ottawa	395	...	122.0
Montgomery	482	...	...
Ottawa	...	357	74.8
Rabun	...	267	...
Ottawa	395	...	75.7
Rabun	299	...	...
Ottawa	...	365	151.2
Rollo	...	552	...
Ottawa	390	...	138.9
Rollo	542	...	...

For the sake of brevity only the average strength of the briquets is shown in the table, but the ranges in the two were comparable and equally small.

These tests show a fair agreement in the strength ratio between briquets of standard Ottawa sand and the sand being tested, using either portland cement or alumina cement.

The breaks of the alumina cement briquets show that the sand grains are broken through. This demonstrates that the cement is sufficiently strong to test the strength of the sand. Frequently when portland cement is used the breaks show a failure of the cement with only a very few broken sand grains. This is particularly true of the test at 7 days. Unless some of the sand grains are broken in the test it would seem that little value can be given to this as a strength test of the sand. High strength cement would furnish a better test of the sand strength as the tendency is for the breaks to occur uniformly through the sand and cement.

Compression Tests—Many engineers are inclined to discount the value of the tensile briquet test for sand. The results are sometimes erratic and better concrete can often be made from a sand than would be indicated by the test. For this reason more weight is being given to concrete compression tests than to mortar briquet tests. The compression tests appear more direct and the results are tangible.

Concrete for compression tests was made, using for coarse aggregate a rounded quartz gravel passing a ½-in. screen and retained on a ¼-in. screen. All concrete was mixed in the proportion of one part of cement, two parts of sand and four parts of gravel. The test cylinders were 3 in. in diameter by 6 in. long.

Cylinders of alumina cement, Ottawa sand, and gravel with water-cement ratio of 50 per cent, at 24 hours, had an average compressive strength of 3,034 lb. per sq.in.

Cylinders of alumina cement, Montgomery sand and gravel at 24 hours had an average compressive strength of 3,904 lb. per sq.in.

Cylinders of alumina cement, Rabun sand, and gravel at 24 hours had an average compressive strength of 2,624 lb. per sq.in.

The ratio of strength between the cylinders of Montgomery sand, and the cylinders of Ottawa sand is 128.6 per cent, and between the Rabun and Ottawa is 86.5 per cent. The corresponding strength ratios by the mortar briquet test were (see Table) 122.0 per cent for the Montgomery and 75.7 per cent for Rabun sand.

Cylinders of portland cement, Ottawa sand, and gravel with a water-cement ratio of 50 per cent, at 28 days had an average compressive strength of 2,592 lb. per sq.in.

Cylinders of portland cement, Bull Creek sand and Bull Creek gravel, with a water-cement ratio of 50 per cen, at 28 days, had an average compressive strength of 2,441 lb. per sq.in.

Cylinders of alumina cement, Bull Creek sand and Bull Creek gravel, at 24 hours, had an average compressive strength of 3,922 lb. per sq.in.

From these comparative tests the ratio of compressive strength between cylinders of portland cement concrete at 28 days and alumina cement concrete at 24 hours is 62.5 per cent for the Bull Creek sand and gravel, and is 85 per cent for Ottawa sand and quartz gravel.

As would be expected with a high strength cement the breaks in the concrete cylinders of alumina cement are frequently through the aggregates, which shows that the strength of the cylinders depends upon the strength of the aggregates. From this it appears that tests using high strength cement show up the strength of the aggregates more than tests using lower strength cement as the failures in the lower strength cement concrete is apt to occur in bond or in the cement rather than by breaking the aggregates.

There has been a notable discrepancy in the reports of compression tests from different laboratories. It is at present not customary to show the water-cement ratio with a report, but it has been demonstrated frequently that only a slight change in the water-cement ratio materially affects the compression strength of the concrete. Probably many of the discrepancies have been caused by the use of slightly different water-cement ratios. In reporting the results of any test of concrete it would seem advisable to show the water-cement ratio used so that the results can be more easily compared or interpreted.

Cylinders of alumina cement, Montgomery sand and gravel, with water-cement ratios of 50 per cent, 57.5 per cent and 65 per cent at 24 hours had average compressive strengths in lb. per sq.in. of 3,880, 3,140 and 2,880 respectively. This shows the variation in strength with the change in the water-cement ratio for alumina cement. The variation is even more marked for portland cement.

Conclusions—The data are not sufficient to justify conclusions at this time. However, the results indicate that a 24-hour test of concrete aggregates is feasible and that the results of these tests are comparable to the results obtained with the present 28-day test.

All tests reported in this article were made in the testing laboratory of the State Highway Department of Georgia.

Local Chapter of Society Can Incorporate

ACCORDING to the recommendation of a master in chancery to the judges of the Superior Court of Cook County, Ill., the Chicago Chapter of the American Association of Engineers was within its rights when it incorporated as under that title in 1923. The recommendation is the result of a complaint brought by the American Association of Engineers against the Chicago chapter praying that an accounting be made between the association and the chapter, that the chapter be decreed to pay to the association whatever may be due it and that the chapter be refrained from the use of the name Chicago Chapter of the American Association of Engineers.

The master's report recites in detail the history of the incorporation of the chapter. He finds that prior to its incorporation the chapter as an incorporated body was authorized to use its name and was the Chicago unit of the complainant organization, that by its incorporation it is not deprived of the right to legally use the name, Chicago Chapter of the American Association of Engineers, that it is legally acting under charter granted to it by the parent body, that the incorporation was the act of the chapter and not of any individual members in the chapter, that none of these members seceded from the parent body and set up a separate organization, but on the contrary the chapter has always asserted that it is a chapter of the American Association subject to its by-laws, rules and regulations legally constituted. Further, that the association has dealt with the chapter and recognized it as its Chicago unit with knowledge of its incorporation.

The master, therefore, recommends, first, that the court has jurisdiction of the subject matter and of the parties, second, that the complainant has not proved its case, and, third, that the equities are with the defendant the chapter—and that the bill of complaint be dismissed.

Mountain Highway Built on Railway Grade

Road Utilizes Abandoned Colorado Midland Ry. Grade, Including Two-Mile Tunnel and Trestles—Construction Work

BUILDING a state highway on 52 miles of abandoned railroad in the Rocky Mountains, including the noted Busk-Ivanhoe tunnel, is a specially interesting development in the work of the Colorado State Highway Department. The Colorado Midland R.R., an example of heavy mountain railroad construction, extended from Colorado Springs to Glenwood Springs, with maximum grade and curvature of 4 per cent and 16 deg. respectively, and crossed the Continental Divide at an elevation of 11,200 ft. by the two-mile tunnel which superseded the original open-air line across the Hagerman Pass. Fig. 1 shows part of the old roadbed, with ties removed in advance of the road grader. Fig. 2 is a map of the new and existing roads, all of which are improved, but without hard surface.

Financial difficulties aggravated by conditions of the World War led to the abandonment of the railway in August, 1918, the rails being then taken up and

FIG. 1—HIGHWAY ON ROADBED OF OLD COLORADO MIDLAND RY.

sold. In order to open up a short direct highway route between Leadville and Glenwood Springs, through a scenic district much favored by visitors and tourists, it was decided to use 52 miles of the old railway roadbed from Leadville to Basalt, including the Busk Tunnel. This resulted in a road only 81 miles long, twelve miles shorter than any other route. The maximum grades are 3 per cent. Much of the route is in heavy rock cuts and sidehill work, and there is one other tunnel, 300 ft. in length.

Roadbed Conversion—In preparing the old roadbed, composed of 18 to 24 in. of cinder ballast, the ties were first removed and then a road grader hauled by a motor truck dressed the surface to shape. On fills, the grader made a deeper cut in order to gain width, so that except at a few rocky points the finished road, normally 18 ft., will be wide enough for two cars to pass. No new surfacing is added, but the roadway is smooth and firm and also free from mud or ruts as the ballast had been compacted by years of traffic and the cinders

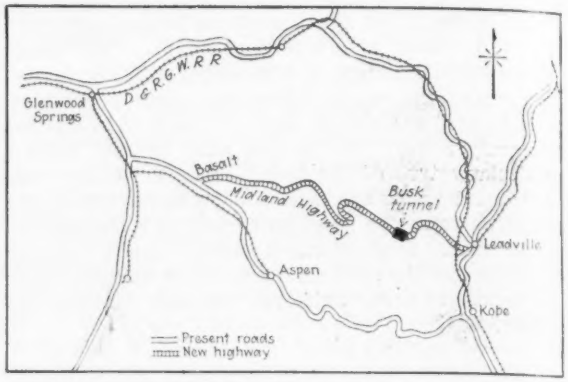


FIG. 2—ROUTE OF MIDLAND HIGHWAY, COLORADO

provide excellent drainage. The railroad trestles were not altered, except that the stringers were laid flat, instead of on edge, to form a solid deck 11 ft. wide with a guard timber 8x8 in. on each side, and wooden handrailing. One of the trestles is shown in Fig. 3. Additional culverts were made of timbers from the old coal chutes, water-tank towers and stations. At all dangerous places a parapet wall of large rocks was built.

Tunnel Revision—The Busk-Ivanhoe tunnel, Fig. 4, two miles long, is on tangent and a small spot of light can be seen from each portal. It has a continuous grade of 1½ per cent ascending to the west. For reconstruction, the work consisted in rebuilding the snowsheds at each end, taking up the ties, placing about 18 in. of fill for the roadbed, constructing a ditch 18 in. deep and 3 ft. wide along the south side for drainage and placing a guard timber or wheel guard on the rubble wall which retains the new fill, as shown in Fig. 4. This guard is braced at intervals of 10 ft. by timbers laid across to the tunnel wall. Outside of the ditch the width of roadway is 12 to 15 ft., increasing to about 18 ft. at the old refuges. The tunnel originally was 24 ft. high from rock floor to arched roof with a clear width of 16 and 18 ft. in unlined and timbered sections respectively. At several places where water comes through the roof in large quantities, timber frames have been built and covered with galvanized iron to shed water to the ditch and thus protect travelers.

The heaviest work on the tunnel is that of placing the new roadbed material, which consists of granite taken from the old dump piles of the tunnel; this material is moved by fresno scrapers to timber traps with hoppers and is dumped through chutes into bottom-dump two-horse wagons. The rock is graded by hand, coarse material being placed in the bottom to give drainage to the side ditch, while the finer material placed on top makes a firm and smooth roadway when compacted. This work is being done from both ends of the tunnel.

Bottom-dump wagons were found very satisfactory as they could be turned easily in the tunnel and could pass each other without difficulty. For lighting, each driver had a miner's cap with carbide lamp, providing sufficient light for the horses to see their way. Similar cap lamps were used by the men engaged in spreading the stone in the tunnel. No compacting is done except by the passage of the wagons.

Tunnel Operation—With a width of 12 to 15 ft. there is room for automobiles to pass, especially as the width is increased to about 18 ft. at intervals by enlarge-

FIG. 3—HIGHWAY ON OLD RAILROAD TRESTLE

ments of the old refuge chambers for trackmen. In operation, automobiles will use their own headlights and eastbound cars will have the right-of-way; that is, when two cars meet, the westbound car will pull to the side when the glare of the opposing lamps becomes troublesome and will then stop and put out all its lights until the eastbound car has passed. There will be no trouble from gas, as the tunnel is well ventilated, a breeze blowing through it continuously. It is expected that a car will make the trip in about ten minutes, and the engineer in charge states that during the work he has driven through in seventeen minutes.

Western Section—Another stretch of the railway roadbed, about 28 miles west of Colorado Springs and extending from Florissant through Howbert to Hartsell, about 36 miles, has been utilized in the same way but with much less work. This diversion gives a maximum grade of 1½ per cent and eliminates the 15 per cent grades on the shorter but more difficult original highway through Wilkerson Pass.

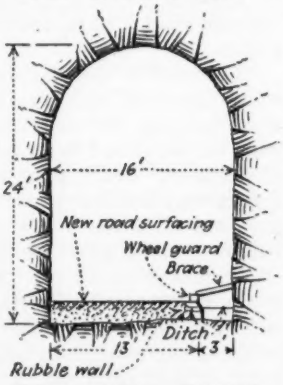


FIG. 4—BUSK TUNNEL CONVERTED FOR HIGHWAY

Progress on the Leadville-Basalt stretch of road has been delayed by the difficulty in holding labor on work at such an altitude, the weather beginning to get cold in August, but it is expected to have it completed by August, 1925. Snow will close the road every winter, but it will be open probably from the middle of June to the middle of November.

Work on the open roadway and the trestles is being done by day labor, with a force averaging twelve men. For the Busk tunnel, the contract was let to C. A. Switzer, of Leadville, who has a force of about twenty men and ten teams, using dump wagons supplied by the State Highway Department. This new highway is being built under the direction of L. D. Blauvelt, state highway engineer, and is in charge of H. L. Jenness, division engineer of the State Highway Department. Its total cost is estimated at $45,000 or about $866 per mile, the right-of-way having been donated by A. E. Carlton, of Glenwood Springs, who was the owner of the Colorado Midland Ry. when it was abandoned.

Specific Requirements Safeguard Road Concrete

IN ORDER to assure better protection of concrete in road construction than is usually obtained, and to eliminate any cause for dispute between engineer and contractor, new specifications recently prepared by Allegheny County (Pittsburgh) fix, by specific statement of quantities, the procedure to be followed by the contractor with respect to hot weather curing and to protection from freezing.

Hot Weather Curing—Burlap protection is required to be applied in warm weather as soon as the concrete has hardened sufficiently not to be injured. This burlap must be in strips 3 to 6 ft. wide, 2½ ft. longer than the width of the pavement, and must be placed with the strips overlapping half their width. The burlap must be thoroughly wet when placed and must be kept wet by spraying until removed.

Sufficient burlap shall be provided by the contractor to cover with two layers all pavement laid in one day.

On removal of the burlap, straw or other covering material must be applied, the pavement surface first being thoroughly wet. The specification for this covering is as follows:

Straw or hay shall be applied at the rate of three standard bales for each 100 sq.yd. of finished concrete. If granulated slag or clay be used it shall be applied so that a compact depth of not less than 2 in. will be obtained over every part of the surface of the concrete roadway.

For each 3,000 sq.yd. of completed concrete surface which has been completed less than nine days the contractor shall provide one man and at least 200 ft. of hose, which man shall devote his entire time to watering the concrete pavement.

Pavement base course, however, may not be covered with earth or clay, but must be covered with hay or straw.

The covering material is required to be left on the pavement for 18 days (14 days for base course) and the pavement then swept clean. Top course may be placed on the base course immediately after such cleaning. In the case of one-course pavement, three additional days' curing after the 18-day covered curing must be allowed before the roadway may be opened to traffic.

There is also the usual clause requiring protection of both one-course pavement and base-course concrete by canvas shelter frames in rainy weather.

Protection from Freezing—The requirements for protection from freezing are expressed definitely in terms of temperature as follows:

Whenever the season of the year justifies the Director in anticipating a temperature of 40 deg. F. or below, the contractor, when so instructed, shall heat the ingredients sufficiently to obtain a temperature of concrete of not less than 60 deg. F. when placed in the form, and by some suitable means the temperature of the concrete shall be maintained at not less than 50 deg. F. for a period of at least 72 hr. after placing.

The same clause applies to pavement base course and to mass concrete.

The new specifications were drawn by P. J. Freeman, chief engineer of the bureau of specifications and tests, and Samuel Eckels, chief engineer of the bureau of roads of the county department of public works, under Norman F. Brown, director, and Charles M. Reppert, assistant director.

Engineering in the Small City

A series of notes from the field on the Problems and Practices of the Municipal Engineer in the Cities Below 100,000

The Editor Visits the City Engineer

Snapshots of Our Representative Small Cities

High School, Wilmington, N.C.

Wilmington, N. C.

COUNTY SEAT OF HANOVER COUNTY, NORTH CAROLINA. Situated 20 miles from mouth of Cape Fear River and has steamship connections with New York and other Atlantic ports. Cotton and lumber are principal shipments. Industries include lumber mills, cotton presses, cotton mills, cottonseed oil mills, wood-working plants, railroad shops, fertilizer works. Settled as Newtown in 1730, incorporated 1739 under present name. In 1743 was capital of the province. Pop. (est. 1924) 33,500.

THE more one studies cities as old as the Revolution and particularly those municipalities of the South where the climate is equable and generally pleasing, the more one is convinced that radical changes in municipal administration are necessary before any great impetus can be given engineering growth. The older the city the more difficult it appears to be rid of age-old traditions. The very walls of municipal buildings seem to echo: "What was good enough for our fathers is good enough for us." With the tremendous increase in manufacture and distribution of automotive vehicles and the penetration of every hamlet by at least passable roads, has come an engineering problem that few city administrations have been able to grasp entirely. Why, then, is there such a lag between the municipal and the state organization and administration of engineering functions? The best answer so far obtainable appears to be that for certain municipalities the old bicameral government is outworn. Some change appears necessary. Where it has been effected it apparently has been very successful. The South needs strict business methods applied to its engineering problems. And Wilmington, North Carolina, is no exception.

Let us take one instance. The city's water supply is taken from the Cape Fear River. Some trouble has been experienced in making the supply free from bacterial content and from turbidity. Until a recent 2-mile pipe line to the northeast fork of the river was put in, water was taken from the river practically in the center of the city. The forks of the river meet about half a mile above the business center of Wilmington. The former water supply was one of varying high color content and turbidity, according to the range of the tides. But that condition was corrected by taking the water from much farther from the city. That was a number of years ago. But the city is still compelled to maintain 37 deep-well pumps throughout its boundaries, because its population cannot believe that the water it is getting now is pure enough to drink. These 37 wells yield an average of from 1,000 to 1,500 gal. per day each. People come to these wells for drinking water. They use city water for every other purpose. And yet the water taken from the mains is as pure now as is obtainable. As a matter of fact the city engineer, who went to Wilmington a number of years ago as the superintendent of the water department only, but who has had all other city engineering work thrust upon him since, has developed the water supply with great care.

The high quality is shown by the following average test of the water by the State Department of Health: Alkalinity, 14.4; chlorides, 5; turbidity, 0; odor, none; B. coli in 10 c.c. sample, none, in 50 c.c. sample, none. The total bacterial count at 38 deg. C. showed 2 at the time the above reading was made.

Wilmington has the commission form of government. The mayor is the commissioner of public safety. The second commissioner is the finance officer and the third the commissioner of public works, under whom the city engineering department is organized, and to which officer the city engineer owes his appointment. The city engineer, McKean Maffitt, has been in Wilmington seven years. He first went to that city merely as the superintendent of water-works, but, as stated above, all other engineering has been given him. And he is his own instrument man and draftsman. He has one assistant, a colored man, who does odd jobs and assists in chaining and grade stake setting. If one wishes to discover, then, why engineering in such municipalities as Wilmington gets no farther than it does, one can find the reason in examining the department of public works.

On June 1 a new director of public works assumed office. Most of his working days so far had been spent as a "baggage smasher" on a railroad. Handling baggage on a railroad is an honorable and necessary piece of business. But it goes without saying that it ill fits a man who for four years is to direct the engineering problems of a city of about 30,000 inhabitants. And that director of public works must be consulted by the city engineer on all matters affecting the department. If the public works director is a man who realizes his lack of technical knowledge and is willing to let the city engineer direct his own affairs as he sees fit, well and good. But if he is not . . .

So far as engineering problems are concerned the city of Wilmington has several worthy of especial note. In the first place the city generally is pretty close to tide level, the highest point being not more than 65 ft. above the ordinary tide range. The topography of the city is such that gravity discharge of sewage is generally possible. The sewage disposal by means other than discharge into the Cape Fear River eventually must come. However, the disposal of storm water is much more difficult.

The city has a number of inherited drainage problems. Old 4x6½-ft. drains take off part of the storm water, but the course is often through private property and not along some street. This means that the city cannot assume any responsibility for construction of new buildings in the neighborhood of such storm drains. This may appear a minor consideration but let us look

at one instance. Not long ago a new building failed because it had straddled one of these drains without the proper possibilities of foundation failure having been accounted for. When new building is contemplated the city engineer lets the owner know the exact position of such drains. If his building is not designed accordingly he assumes all responsibility, and incidentally the building inspector is concerned principally with a building's fire-resistive qualities. What should be done, obviously, is that extreme foundation possibilities should be met. These old drains were laid many years ago, before the general street layout of the city was accomplished, and since they traverse what is now private property, it is obvious that the city would be bankrupt should it assume entire responsibility.

Provision for adequate storm-water drainage meets another disadvantage—rainfall that shows any regularity. Sooner or later considerable expense must be involved in providing for disposal of storm water. But the following figures will give an idea of the impossi-

DAMAGE DONE BY EXCESSIVE RAIN OF JULY 21, 1924, AT WILMINGTON

bility of designing for an ideal condition. Mr. Maffitt three years ago plotted the curves showing the rainfall intensity for the previous 17 years. This gave data whereby it appeared reasonable to base storm sewer design on a rainfall of 5 in. per hour for the first five minutes or 1.3 in. per hour for the first two hours. But on Sept. 23, 1923, there was recorded a rainfall of 8 in. per hour for the first five minutes; 6½ in. per hour for the first 10 minutes; 5.2 in. per hour for the first 30 minutes; and 2.8 in. per hour for the first hour. This was not so bad, but the very next season, on July 21, 1924, these figures were upset by the following rainfall: 5.3 in. per hour for the first 5 minutes; 5.1 in. per hour for the first 10 minutes; 3.95 in. per hour for the first 30 minutes; 3.60 in. per hour for the first hour and 4.90 in. per hour for the first two hours The peak of the flood, therefore, came toward the end of the rainfall. Obviously, it is difficult to make any adequate provision for such freakish rainfalls, yet it is one of the things a city engineer must take into account.

That rainfall for 1924 played havoc with the city. The damage it wrought to paving and property may be seen from the accompanying photograph. This was taken as the rain was subsiding.

As the installation of adequate storm drainage for the city as a whole would be quite expensive, it has been suggested that those portions of the city recently developed be included in a drainage district, the abutting property to pay the cost of the installations.

As the city of Wilmington has practically no local paving materials and must import rock and brick from considerable distances, the paving situation is interesting. Where local materials are not available it is interesting to note that asphalt is a popular type. The flexibility of the surfacing is presumed to be the reason, that is, if a street, laid with any sort of hard surface a quarter of a century ago, can be easily reclaimed with surfacing and patching. In Wilmington use is made of every bit of available material, even incinerator waste. For instance the following types are found on the streets of the city, in about 52 miles of streets:

Belgian block
Plain sand
Incinerator refuse covered with ashes
Incinerator refuse covered with penetration asphalt
Cochina stone, plain
Cochina stone with penetration top
Cochina stone with sheet asphalt top
Cochina stone with Kentucky rock asphalt
Brick on a concrete base
Sheet asphalt on a concrete base
Bitulithic on concrete base
Topeka surface on concrete base
Kentucky rock asphalt on concrete base
Brick on sand base, both grouted and with no filler
Brick on a cochina stone base
Brick on sawdust base
Asphalt block on cochina stone base
Asphalt block on stone base
Plain sand-clay

Unless it be asphalt there is no prevailing type, though that material has been the most generally used recently. The cochina is a limestone impregnated with oyster and other shells. It is the only stone locally available. The streets laid with incinerator refuse are dusty and ragged. But it is the opinion of the director of public works that such waste should be saved for street surfacing. In some cases the surface it gives is fairly satisfactory for light traffic, but the wind and rain shred it considerably. Its general economy may be questioned, when it is recorded that a city motor vehicle picked up 14 nails in one 366-ft. block.

One final bit of information found in city engineering work is that which has to do with street work. The city has no responsibility outside the actual street width. Sidewalk work is done at private expense. That means that one may find every sort and width of sidewalk within the length of one block. The city engineer is not given any authority to align existing building lines.

More than half a century ago the legislature passed a law prohibiting the city from aligning property lines except where new buildings replaced old ones. Therefore the city engineer goes about and whenever he finds an old building which theretofore has jutted into the street being rebuilt, he is able to make the new building conform to width regulations. But the effect of such a law has been to defer needed reconstruction.

Such cities as Wilmington must grow up. Though its port and agricultural life are its main support, it is benefiting to an extent by a rapid extension of textile manufacturing in other communities. But its engineering growth will not be healthy until some means are employed to give to technical men of experience the full responsibility of engineering development. And that probably means an entire change in municipal administration. No matter what the change might be some change doubtless would prove beneficial. But at

least it is apparent that engineers must be given credit for the possession of technical judgment and a free hand in the development of engineering problems.

Centrifugal Pumps at Waterville Meet Unusual Requirements

By Arthur L. Shaw
Designing Engineer, Metcalf & Eddy, Boston, Mass.

THE wide range of total head conditions—resulting from varying friction losses in 8.4 miles of supply aqueduct and in a somewhat restricted distribution system, at different rates of pumping—complicated the basic requirements for the centrifugal pumps for the new pumping station of the Kennebec Water District, Waterville, Maine.

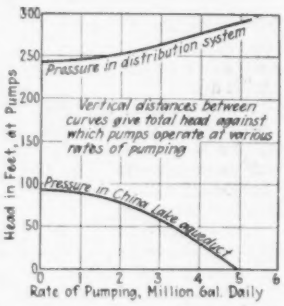

Pressure in distribution system
Vertical distances between curves give total head against which pumps operate at various rates of pumping
Pressure in China Lake aqueduct
Head in Feet, at Pumps
Rate of Pumping, Million Gal. Daily

FIG. 1—RELATION BETWEEN RATE OF PUMPING AND TOTAL PUMPING HEAD, WATERVILLE WATER-WORKS

On the suction side of the pumps the head varies from over 90 ft. static pressure to about 12 ft. suction lift at a pumping rate of 5.3 m.g.d., due to the friction loss in the twenty-year-old aqueduct of 20- and 24-in. pipe, the present coefficient for which in the Hazen and Williams formula is somewhat in excess of 110. The discharge pressure varies from about 105 to 126 lb. static at the 5.3-m.g.d. pumping rate. Fig. 1 illustrates these conditions and indicates that for pumping rates from about 2 m.g.d. minimum to about 5.3 m.g.d. maximum the total head will vary from 175 to 307 ft. and that the pumps should be able to operate with reasonable efficiency between these limits, an unusually wide range of head for the centrifugal type.

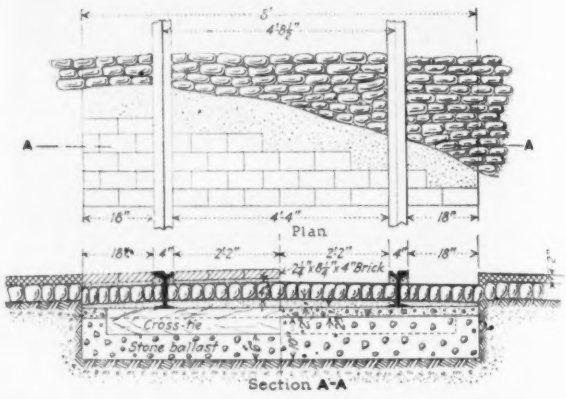
The solution was found in pumping units consisting of two series-connected single-stage pumps with the series piping cross-connected and gated so that a single pump could be run to meet the low-head-low-rate requirements, by removing the bolts from the flexible coupling between the pumps. The characteristics of the units when running series-connected were so chosen that with units running alone or in any possible combination with other units reasonable efficiency would be secured.

Fig. 2 gives the characteristics of the three units as determined by the acceptance tests and shows the manner in which the "operating range" covers the highest portion of the efficiency curve.

Bricks Laid Flat on Cobblestone Base

THE city of Lynchburg, Va., is planning to lay during the present construction season a type of paving which, it is believed, has been little used. Essentially it is a brick wearing surface laid flat on a cobblestone base with a ¾-in. sand cushion and with asphalt-filled joints. The city has a considerable mileage of cobblestone paving and it is the idea that as much of this as can should be preserved as the base for a more smooth wearing surface. Also, the cobblestone having been down a quarter of a century or more the surface has become worn and potholed until reconstruction of some sort is necessary.

The particular stretch of paving on which this new type is to be used is confined to an 8-ft. center strip occupied by the street railway. In the reconstruction crossties will be bedded in stone ballast 10 in. deep. Upon this will be placed a 2-in. layer of cement grout, effectively sealing the ballast. A sand cushion 2 in. more or less thick will underlie the 4-in. rubble block, this cushion being brought to the required finished crown section. Upon the rubble block which will be filled with chips and sand will be spread a ¾-in. sand



PROPOSED RECONSTRUCTION OF LYNCHBURG, VA., STREET

cement cushion of a 1:4 mix. The brick will be laid flat on this cushion and the joints filled with asphalt. The roadway outside the track area will be surfaced directly upon the cobblestones with a 2-in. thickness of asphaltic concrete.

The work will be done under the bureau of engineering of the Department of Public Works. R. W. D. Hart is director of public works.

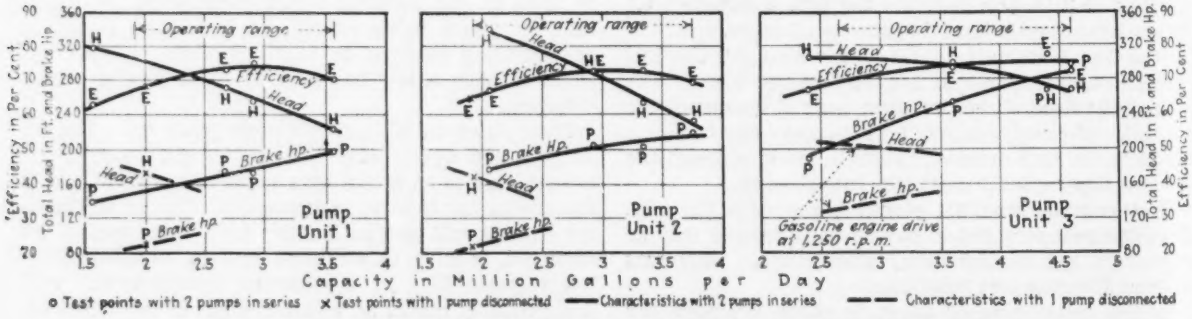

Operating range
Efficiency
Head
Brake hp.
Pump Unit 1
Pump Unit 2
Pump Unit 3
Gasoline engine drive at 1,250 r.p.m.
Efficiency in Per Cent
Total Head in Ft. and Brake Hp.
Capacity in Million Gallons per Day
Test points with 2 pumps in series
Test points with 1 pump disconnected
Characteristics with 2 pumps in series
Characteristics with 1 pump disconnected

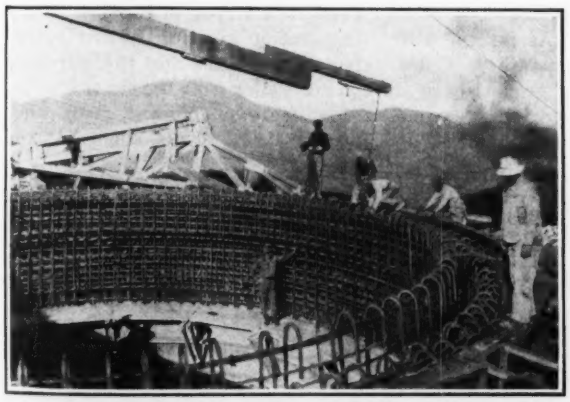
FIG. 2—TEST CHARACTERISTICS OF PUMPING UNITS, WATERVILLE WATER-WORKS
The speed for Units 1 and 2 was 1,180 r.p.m. and for Unit 3, 1,185 r.p.m.

Present Status of San Francisco's Hetch Hetchy Project

A Summary of Construction and Expenditures to Date and a Résumé of Work Still Necessary Before Water Can Be Delivered—Power Sale Debate Continues

THE Hetch Hetchy project, which is to bring a mountain water supply to San Francisco and which is also being developed as a source of power, has been in process of construction for a decade. To date about $44,000,000 has been spent (not including a large total of bond interest payments), much has been accomplished and some parts of the project have been completed, including the 93,000-hp. plant at Moccasin Creek. A $10,000,000 bond issue was approved last October to complete the foot hill tunnel and do preliminary work on the Coast Range tunnel. Work yet to be done before Hetch Hetchy water can be delivered to San Francisco, and for which bond issues have not yet been voted, is estimated to cost about $23,000,000, of which $15,000,000 is to be used on the 31-mile Coast Range tunnel and $8,000,000 on the 45-mile pipe line across the San Joaquin Valley. The actual construction involved in completing the tunnels and other features of the work yet to be done before Hetch Hetchy water can reach the city is estimated to require about six years.

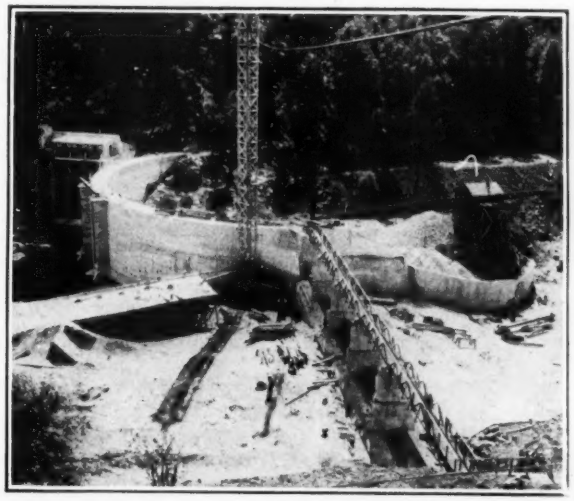
Historical Data—In 1908 the city obtained from the Secretary of the Interior the "Garfield permit" for reservoir sites in Yosemite National Park and aqueduct rights over public lands. The first bond issue, for $600,000, was voted in 1908. In January, 1910 (by a majority of 20 to 1), the city voted a $45,000,000 bond issue "for bringing a water supply to San Francisco from the upper reaches of the Tuolumne River." This issue was based on the Manson and Grunsky plans, both of which proposed pipe lines through Altamont Pass with pumping plants and short tunnels and did not contemplate the development of large amounts of power.



HEAVY REINFORCING IN TOP OF SURGE CHAMBER

This structure at upper end of penstock has an inside diameter of 40 ft. and a total height of 160 ft., of which 48 ft. projects above ground. Walls are heavily reinforced with 1¼-in. bars on 7-in. centers.

In 1910 John R. Freeman was retained by the city to report on the Hetch Hetchy project. His report proposed an all-gravity system of delivery with much longer tunnels and included a series of power plants. Then in 1913 Congress, with the Freeman report and reports of a board of army engineers and city engineer O'Shaughnessy before it, passed the Raker Act. This act carried the provision that irrigationists on the Tuolumne should be allowed such stored water at a predetermined cost, as they could profitably use and it stipulated that 10,000 hp. of hydro-electric power must be developed within three years after completing works adapted for power production, and 60,000 hp. within 20 years.



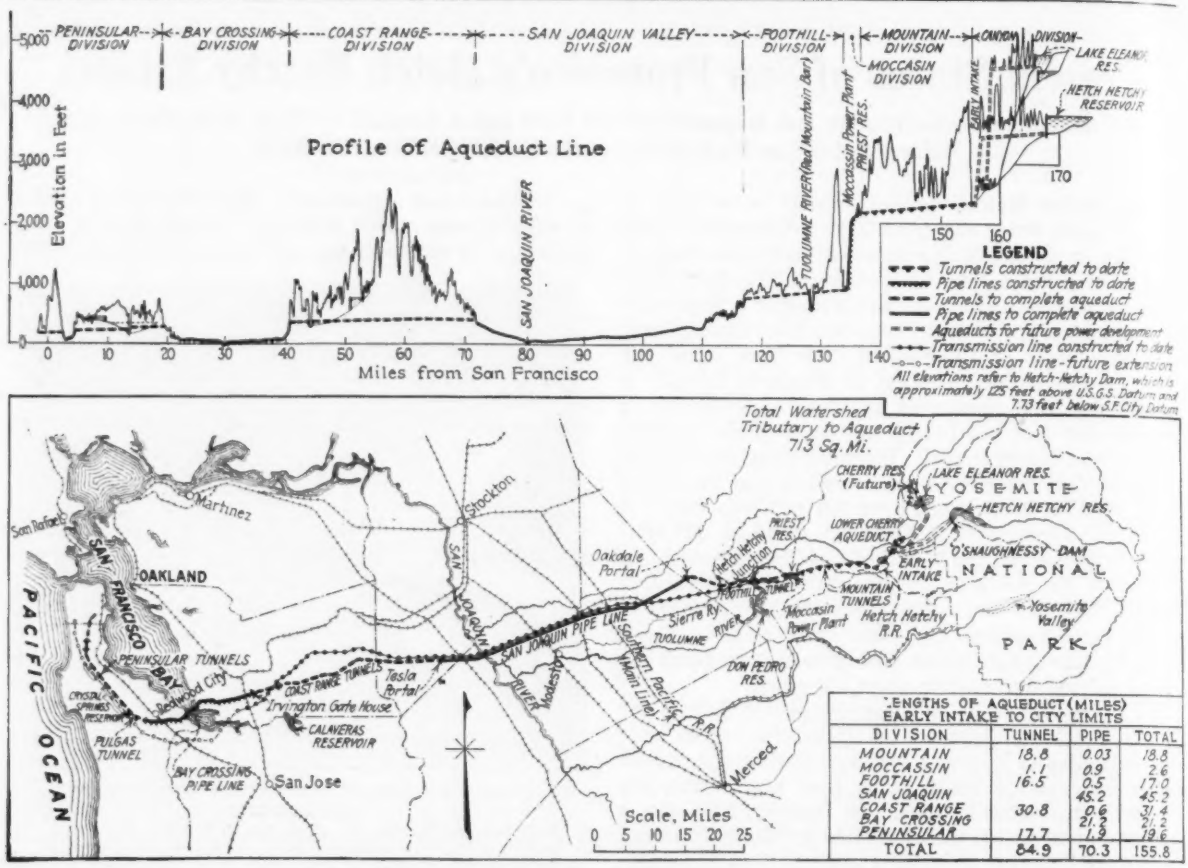
DIVERSION WORKS, UPPER END OF HETCH HETCHY AQUEDUCT

Arch dam, radius 100 ft. Crest length 262 ft. Arch abutment in foreground is 3,600-cu.yd. concrete block. Aqueduct intake in left background. Spillway 130 ft. long will release water for Don Pedro irrigation reservoir 40 miles downstream. Spillway gates are automatic, designed to maintain water surface at desired level.

Construction to Date—Construction was started in 1914 but was slowed down by war conditions in the early stages. When it became obvious that the more extensive program laid out by Mr. Freeman and the higher level of all costs due to the war made the original bond issue insufficient to complete the project, it was decided that the mountain division, including the first power plant, should be completed as a unit, thus gaining as early as possible the advantage of power revenue which would help carry interest charges.

The major items and the cost of the work completed to date are listed in the accompanying table. The work now actively under way includes grouting in the tunnels, construction of the intake tower in Priest reservoir, final work on the Moccasin Creek power house and the completion of the bay-crossing pipe line, the last being needed immediately for bringing in water from the Calaveras basin to supplement sources whose capacity has been reached.

The Power Problem—The question of what to do with power from the Moccasin Creek plant has been continuously before the San Francisco Board of Supervisors for three years and has been the subject of prolonged wrangle and debate but up to the time that the power was almost ready for delivery no arrangement for its disposal had been made. The plant can go into service this summer, if any definite plan for disposal of the power is settled upon by that time.



LENGTHS OF AQUEDUCT (MILES) EARLY INTAKE TO CITY LIMITS

DIVISION	TUNNEL	PIPE	TOTAL
MOUNTAIN	18.8	0.03	18.8
MOCCASSIN	1.1	0.9	2.6
FOOTHILL	16.5	0.5	17.0
SAN JOAQUIN		45.2	45.2
COAST RANGE	30.8	0.6	31.4
BAY CROSSING		21.2	21.2
PENINSULAR	17.7	1.9	19.6
TOTAL	84.9	70.3	155.8

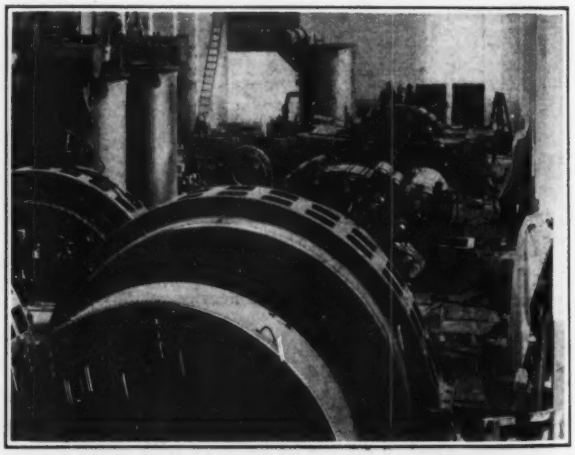
GENERAL MAP AND PROFILE OF HETCH HETCHY PROJECT

Private electrical distribution systems in San Francisco which the city might take over, if the voters decide that the city must go into the power distribution business, are now being valued by the California Railroad Commission but the work cannot be completed until this fall. That delay plus the time necessary for calling a general election and other legal procedure are estimated to involve at least a two-year period before the city could have its own distribution system. This emphasizes the need for some temporary plan of profitable disposal of the "power crop" for which the city is offered $2,000,000 per year. The plan urged by many is that the power should be wholesaled to a private company.

Present Water Situation—With reference to the water situation as distinct from the power phase of Hetch Hetchy development, the city engineer on March 13, 1925, made a report to the board of supervisors in which he stressed the danger of water shortage. "It is imperative," he said, "that water from the Hetch Hetchy project be delivered to San Francisco not later than January, 1931." This is based on figures which show that at the present rate of increase in water consumption the sources now supplying the city will be exhausted in 1930.

The present water consumption of San Francisco, as supplied by the Spring Valley Water Co., is about 42 m.g.d. The rate to small consumers is 29c. per 1,000 gal. plus a monthly service charge. With the completion of the bay-crossing division an additional supply can be brought in from the Calaveras watershed but Mr. O'Shaughnessy estimates the total amount that can be brought in economically from all sources, prior to Hetch Hetchy delivery, as 60 m.g.d. This will not supply the city's needs, he points out, for longer than the next six years, even assuming that no territory outside the city of San Francisco proper is supplied.

As for the water distribution system, the city voters have three times defeated measures for the purchase of properties of the Spring Valley Co.; the election dates and the prices voted upon were as follows: 1910, $35,000,000; 1915, $34,500,000; 1921, $37,000,000. At the



INTERIOR OF MOCASSIN CREEK POWER HOUSE

The first installation consists of four 25,000-hp. double overhung impulse wheels to operate under a head of 1,250 ft. The plant is 900 ft. above sea level and this head is to be used for delivering water by gravity to San Francisco reservoir 135 miles away.

last election the plan failed to get the necessary two-thirds majority by only 6,000 votes and it is believed that the people are coming to a realization of the necessity of purchasing the distribution system.

The Railroad Commission has valued the Spring Valley properties at $37,000,000, as of March, 1920. This figure the company has agreed to accept (plus improvements and less amortization payments) at any time before the end of 1931.

Work Yet to be Done—A bond issue approved by the city last October (by a majority of 20 to 1) authorized another $10,000,000 for expenditure on the Hetch Hetchy project in the next three years. Of this sum, about $8,000,000 is to be used for constructing the 17-mile foothill tunnel west of Moccasin Creek and $2,000,000 for shafts and preliminary work in the 31-mile Coast Range tunnel. Survey crews are now in the field on this work.

In addition to the use of funds now available, the city's plan is to vote a $23,000,000 bond issue about 2½ years hence. This amount is to finish the first of two parallel coast range tunnels each with a capacity of 200 m.g.d. or half that of the mountain-division tunnel. The pipe line across the San Joaquin Valley, which could be paralleled at any time, would at the outset be built as a single 5-ft. pipe with a 60 m.g.d. capacity.

Summary—The Hetch Hetchy project has now reached the stage where its power production will help pay interest charges; Hetch Hetchy water could be brought to the city in about six years under the present construction plan if one more bond issue of $23,000,000 were voted. That issue would bring the total of bond issues voted for water and power phases of the project up to $78,000,000. No date has yet been set for further consideration of the Spring Valley purchase.

COST OF HETCH HETCHY WORK COMPLETED TO SPRING OF 1925*

	Cost	
Water construction		
O'Shaughnessy dam	$7,427,000	
Mountain Division tunnels (18 mi.)	9,944,000	
Diversion works at early intake	774,000	
Other work, including sawmill, rights of way, boarding houses, Red Mountain Bar siphon, etc.	1,321,000	
		$19,466,000
Power construction		
Eleanor dam	373,000	
Priest dam, Moccasin power tunnel	2,071,000	
Moccasin penstock pipes	1,996,000	
Power house and buildings	1,164,000	
Power plant equipment	1,125,000	
Cherry Creek power plant	639,000	
Transmission lines, Moccasin to Newark	1,556,000	
Other items, including lands and rights of way, power plant operation, etc.	470,000	
		9,364,000
General Mountain Division		
Railroad, hospital, camp operation, etc.		6,445,000
Bay Division		
Pulgas tunnel	757,000	
Riveted steel pipe line (60-in.)	2,391,000	
Dumbarton pipe bridge	1,484,000	
Submarine pipe lines	564,000	
Other items, including lands and rights of way, gate valves, trestles, etc.	584,000	
		5,779,000
General, for whole project		
Administration, government payments, miscellaneous		2,925,000
Grand Total		$43,979,000

* Not including interest on bonds.

ESTIMATED COST OF HETCH HETCHY WORKS NOT YET UNDER WAY, BUT REQUIRED FOR FIRST WATER DELIVERY

	Estimated Total Cost	Amount Already Voted	Estimated Construction Period (Years)
Foot-hill tunnel (17 mi.)	$8,000,000	$8,000,000	3 to 4
San Joaquin Valley pipe line (45 mi.)	8,000,000	.....	2 to 3
Coast Range tunnels (31 mi.)	17,000,000	2,000,000	5 to 6
	$33,000,000	$10,000,000	
Acquisition of Spring Valley properties*	$38,000,000		

* Not part of Hetch Hetchy project but needed for distribution.

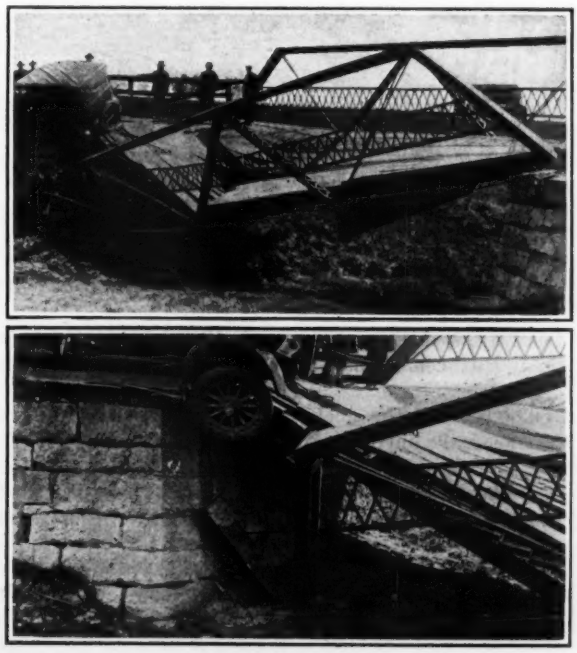
Construction on the project has been continuously under the direction of M. M. O'Shaughnessy who has been city engineer since 1912; since 1921 Nelson A. Eckart has been principal assistant. Leslie W. Stocker is office engineer in charge of specifications; Paul J. Ost is chief electrical engineer; and R. P. McIntosh is chief designing engineer.

Indexes of *Engineering News-Record* carry a long list of articles devoted to the Hetch Hetchy enterprise. These give a comprehensive record of the chief features of the work because during the entire construction period a member of the editorial staff has been stationed in San Francisco. A few of these articles dealing with salient features of the project or its history are listed in the following, the first reference being to *Engineering News*, the rest to *Engineering News-Record*.

"A Notable Water Supply Report" (*Eng. News*)	Dec.	26, 1912,	p. 1207
"Multiple Arch Dam at Lake Eleanor"	Sept.	4, 1919,	p. 464
"New Plans for Hetch Hetchy"	April	1, 1920,	p. 649
"Hetch Hetchy Dam Foundations"	Aug.	11, 1921,	p. 222
"Plant and Program on the Hetch Hetchy Dam"	Sept.	21, 1922,	p. 464
"Dry Fill and Hydraulic Sluice Methods on Priest Dam"	Dec.	21, 1922,	p. 1073
"Building Moccasin Creek Penstock"	Nov.	27, 1924,	p. 858
"Lining the Hetch Hetchy Tunnels"	Feb.	26, 1925,	p. 350

Automobile Strikes End Post of Bridge

HOW a Ford car wrecked a fairly substantial steel-truss highway bridge is shown by the two adjoining views and the following account given by F. F. Healey, of Rochelle, Ill. A Ford approached the bridge from the north (upper in the views), and struck the end post, which was composed of a pair of 7-in. channels and a cover plate. At about the same time a heavier car came on the bridge in the opposite direction, but crossed the span before the bridge fell. In doing so it swung over to the other side of the bridge and knocked the Ford over the abutment, itself coming to a dead stop at the same time. The accident happened at nine o'clock at night. Both cars were running at high speed. The end post was cracked and buckled nearly double.



FORD CAR WRECKS BRIDGE AT ROCHELLE, ILL., BY BREAKING END POST

Work Starts on Port Development at Mobile, Alabama

Piers to Be Built Along Mobile River—Suction Dredge to Excavate Slips and Fill in Land for Piers and Tracks

By A. C. Davis
Designing Engineer, Alabama State Docks Commission, Mobile, Ala.

THE STATE of Alabama is developing the port of Mobile by the construction of a number of large slips and piers with railroad connections and interchange yards at the northern side of the city along the Mobile River. The work has been financed by the sale of state bonds and is being carried out under the direction of the State Docks Commission, a body created for the purpose. In the design of the new port facilities the commission is endeavoring to provide for the rapid and economical handling of cargoes and for extensive shipside warehouses. In this it has encountered many local conditions which make the problem an interesting one.

The site of the docks is within the city limits of Mobile and conveniently located with respect to the city and the railroads entering it but in a section that at present is low, level and swampy. For this reason the ground elevation of the entire project will be raised about seven feet above its present level by pumping in sand from the river.

The main line of the Louisville & Nashville R.R. runs through the site, parallel to and near the river. In order to build the docks, it is first necessary to move the railroad to a position about 1,800 ft. west of its present location. Work on this relocation is now under way. Until it is completed, it will not be possible to build any of the docks.

The docks will consist of a series of slips with filled piers between. The depth of the slips will be 35 ft. from low water, the width 350 ft. and the length 1,600 ft. The length of 1,600 ft. allows three large cargo boats to be tied on each side. The slips are given an angle to get as much length as possible, to make it easy to bring tracks onto the piers, and to facilitate the entrance and exit of ships. The current in the river will cause all ships to come out of the slips stern downstream, irrespective of angle of slip.

The standard pier will be about 560 ft. wide. On each side there will be an apron 42 ft. wide, back of which a shed 180 ft. wide will be placed. There will be three tracks on the apron and two depressed tracks back of the rear platform. The rear platform will be about 14 ft. wide, the intent being to provide a platform to work the cars without the necessity of spotting them in front of a door as would be required if the platform were omitted. A canopy will be provided over this platform to allow uninterrupted loading or unloading of cars. Along the middle of the pier a vehicle roadway will run with ramps at various points to provide access to the sheds without the necessity of maintaining an open passageway the length of the sheds.

Of the three tracks on the apron, the front track will allow the handling of material with the ship's tackle to or from an open-top car, the second track the handling of material to or from box cars, and the third track will be a passing track to allow switching the last berth without stopping work on a ship in the first or second berth. This arrangement, while providing more shipside tracks than usual, is necessitated by the large amount of iron, steel and timber products shipped through this port, which can most advantageously be handled from car to ship, thus materially reducing the handling costs. The rails for the tracks will be put in slots with the top of the rail flush with the deck. The slot will be filled except for the flange groove, in order to provide a smooth surface for hand trucking.

The apron will be constructed of reinforced concrete and will be supported on concrete piles. The pile bents will be put on 20 ft. centers and beams under rails as well as floorbeams will be of reinforced concrete.

The apron structure will be 70 ft. wide extending partly under the shed, that part under the shed being designed for a live-load of 300 lb. per square foot. At the rear of the apron a laminated creosoted sheet-piling bulkhead will extend down to a stratum of hard sand.

The standard width of shed adopted is 180 ft. This width allows, should future demands require it, the assembling on one floor of a full cargo before arrival of the ship, or allows the unloading of a full cargo

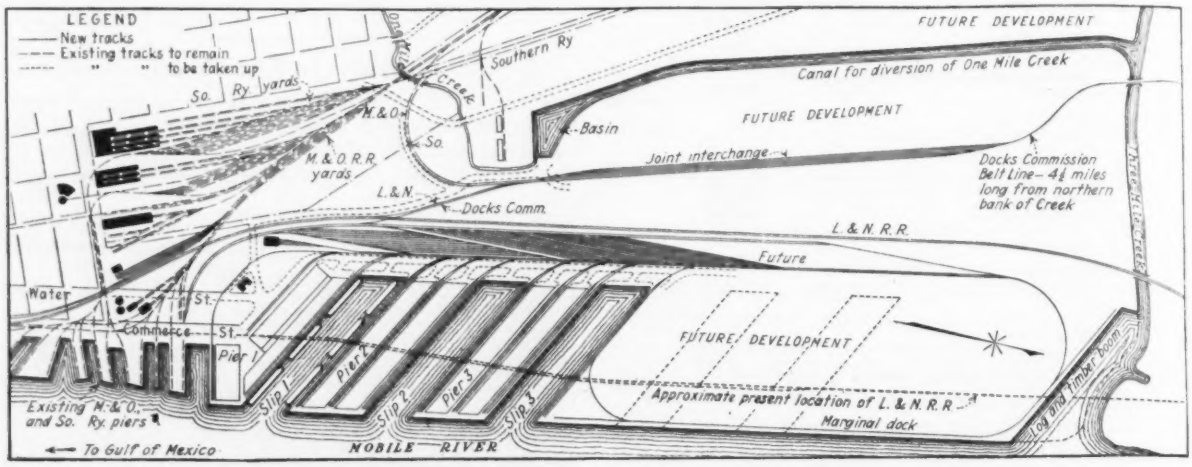


FIG. 1—GENERAL LAYOUT OF MOBILE PORT DEVELOPMENT

without the delay incident to loading on cars or trucks. Only about 25 per cent of the cargo of outgoing ships is now of such a character as to be unloaded in a transit shed, and until conditions change, 120 ft. of the transit shed will be used as shipside warehouses. Should the transit shed demands call for more of this space, other warehouses will be built.

The sheds will be of structural steel with corrugated sides and a tar and gravel roof laid on heavy wood sheathing. The steel trusses will be built for a span of 60 ft. and will be placed on 20-ft. centers. Rolling steel doors 20 ft. wide by 12 ft. high will be placed in alternate bays on both the front and the rear of the sheds.

In order to reduce the fire hazard, concrete fire walls will be provided to divide the shed into sections. A row of hydrants will run down the middle of each pier and standpipes with hose will be provided along the front of the sheds arranged to protect either the wharf or the shed.

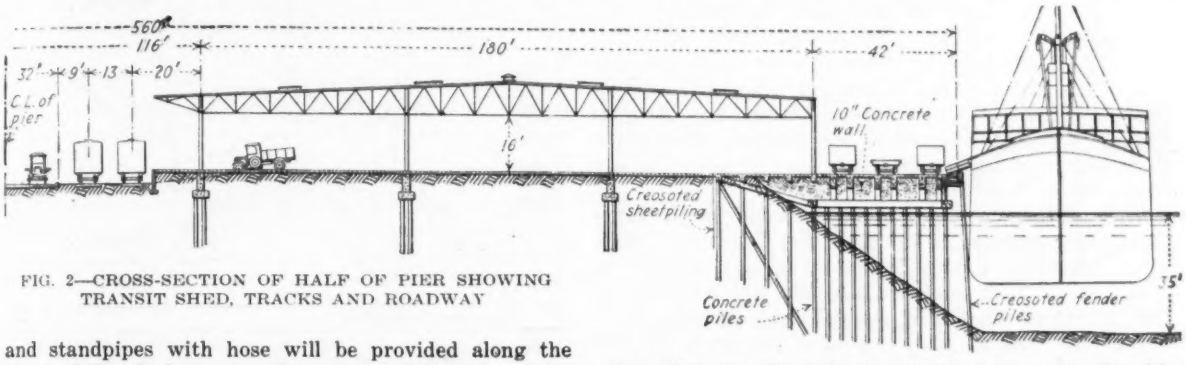


FIG. 2—CROSS-SECTION OF HALF OF PIER SHOWING TRANSIT SHED, TRACKS AND ROADWAY

The sheds will have a floor of reinforced concrete, 6 in. thick, resting directly on the fill. It will be laid with a grade of 0.5 sloping both ways from the middle of the shed.

The foundation conditions are such that piles are required under all heavy loads. Below a depth of 10 or 12 ft. the underlying material is sand. The column footings will be of concrete down to the permanent water level carried on untreated wood piles.

The range of tide at this point is only about 1½ ft., but in times of great storms the water level has been known to rise 9 ft. The piers will, therefore, be placed at elevation +11.0, which is well above the highest water from storms, in order to protect cargo that would be damaged by water.

The ends of the slips will have a bulkhead wall in front of which will be provided a landing for tugs and small boats. This will all be constructed of creosoted materials.

Railroad Connections—There will be a joint interchange yard, with every railroad entering Mobile having tracks therein. This will be used for interchange of cars between railroads as well as between docks and railroads. A Mobile & Ohio switch engine, for instance, can bring into this yard all cars for the docks and the other railroads and place such cars on a receiving track of any particular carrier. When ready to return to its own yard, it will find on its own receiving track all cars from the docks and other railroads. This interchange yard puts all railroads on an equal basis in handling freight to and from the docks.

The commission owns a belt railroad and will own and operate all the switch yards necessary for use in connection with the project. The commission switch engines will be the only ones operating on the docks. The Gulf, Mobile & Northern R.R. will, of necessity, enter the interchange yard over the belt railroad; and any new road seeking entrance to Mobile can, via this road, connect with all other roads entering Mobile, as well as with the docks.

Port Facilities—The plan adopted includes the construction of a fireproof cotton warehouse and compress, and space is provided for future construction of a grain elevator, coal handling plant and other facilities as the commerce of the port may require.

Open storage space will be provided for those commodities which do not require shelter and provision will be made for storage of such articles convenient to the docks.

The amount of cargo handling equipment will be kept at a minimum, the intention being to use ships' tackle as much as possible. Hand trucks and electric trucks and trailers will be used to handle the cargo between the shipside and the transit shed or warehouse.

The development is in direct charge of Major-General William L. Sibert, chairman and chief engineer of the State Docks Commission. John L. Cummings is the principal assistant engineer, and in charge of all construction work; the author is the designing engineer.

American Industry Improves Its Efficiency

American industry is making bid strides in increasing its efficiency. More goods are being turned out with less labor, and particularly since the war, also with proportionately less machine power. The amount of labor and installed primary power since 1914 has definitely decreased in proportion to the volume of production, owing largely to increased efficiency in management and technical labor saving improvements, in the view of the National Industrial Conference Board. The volume of production, according to a chart prepared by the board, during the last quarter century (1899 to 1923) has increased 185 per cent, while the number of wage earners during that time has increased only 90 per cent; installed primary power going into the productive process, during the same period increased 236 per cent. The increased use of machinery, however, does not tell the entire story, for, according to the chart, installed primary power and labor employed both dropped off in proportion to the volume of production since the year 1924. This, in the view of the conference board, indicates that administrative and technical improvements in the utilization of both labor and power are playing an increasingly important part in the growth of production.

Metropolitan Sewer Plan for Los Angeles County

Three of Several Proposed Districts Have Voted $9,120,000 Bonds for Trunk Sewers, Screens and Ocean Outlet

By A. K. Warren
Chief Engineer, Metropolitan Sewer Districts
Los Angeles, County California

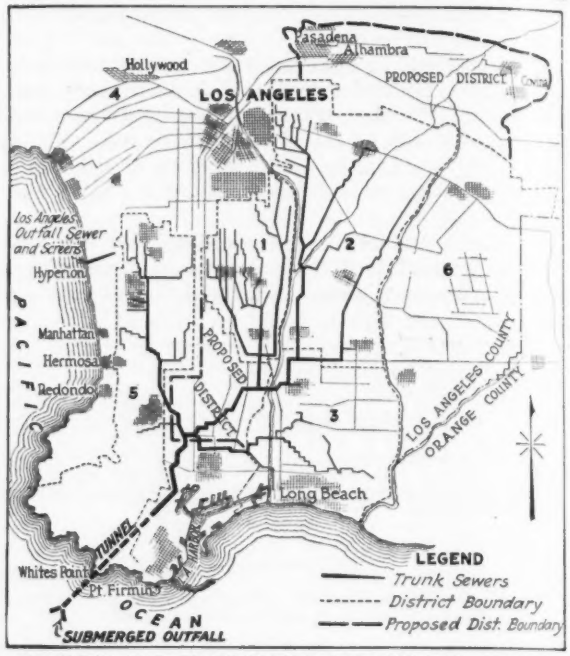
IN FEBRUARY, 1925, three sanitation districts in Los Angeles County, Calif., cast a large majority of votes for bond issues totaling $9,120,000 for the construction of trunk sewers, with discharge into the Pacific Ocean after screening. Other districts that are likely to come into the joint plan and swell the construction fund are in various stages of formation or promotion. This action was prompted by the growth in population and area of the cities surrounding Los Angeles until the only separating lines were the political boundaries and it was almost impossible for any of the cities to find a site for individual sewage-works. Where the population within Los Angeles County is not so dense there are unincorporated areas that need sewerage facilities but have no governmental organization to provide them.

To meet the situation just sketched and for the benefit of other portions of the state, the California Legislature passed the County Sanitation District Act (Chap. 250, Laws of 1923, approved May 29) which authorizes the formation of districts, which may include incorporated as well as unincorporated territory, for the purpose of sewage collection, treatment and disposal. The organization of such a district is vested in the county board of supervisors, subject to referendum on petition of 2 per cent of registered electors. After its creation the district is governed by a board of directors, generally consisting of the president of the board of trustees of each of the cities included within the district, together with the chairman of the board of supervisors of the county. Funds for the construction of the trunk sewers are provided through a bond issue authorized by a two-thirds majority of the votes cast at a special election.

In Los Angeles County six such districts had been formed and two more were well along toward formation by the middle of May. These districts contain 16 cities and as many more unincorporated towns and include almost all the county lying south and east of the city of Los Angeles. Inasmuch as four of these districts were formed at nearly the same time an excellent opportunity was given to outline a plan for joint disposal. Local disposal was abandoned in favor of ocean disposal because of the lack of sites and of the public disapproval of local treatment plants. Districts 1, 2 and 5 have already voted bonds to the extent of $9,120,000. These bonds bear 5½ per cent interest; enough have been sold to make it possible for the work to proceed immediately. Districts whose formation has been proposed but not yet completed are shown with dotted outlines on the accompanying map. The dates of election in these proposed districts had not been set when this article was being written.

The plan as a whole proposes a gravity system to the ocean, comprising 150 miles of trunk sewers within the several districts in addition to some 20 miles of joint trunk sewers. The present estimated population of the combined districts is 377,000 and the project has been laid out to provide ample sewer capacity for a population of 1,300,000, or about four times the present figure. This fourfold increase is expected to occur within twenty years.

The assessed valuation of the districts involved is



GENERAL MAP OF PROPOSED LOS ANGELES COUNTY METROPOLITAN TRUNK SEWER SYSTEM

Showing location of the proposed trunk sewer system and the proposed submerged ocean outfall for Districts 1, 2, 3, 5 and 6. District 4 in West Hollywood recently voted 30 to 1 to construct trunk line sewers which are to connect with the Los Angeles city system. Redondo, Hermosa and Manhattan, in an affiliation known as the South Bay Cities Sanitation District, authorized bonds by a vote of 12 to 1 and construction is under way for a trunk sewer to deliver sewage from this district to the Los Angeles outfall at Hyperion where the city's recently completed outfall and fine screening plant is now in operation.

$343,428,490—which is estimated to be about 50 per cent of actual value. Aside from its magnitude the project thus far shows no unusual engineering features.

Fine screens are proposed for the lower end of the joint outlet sewer, which would discharge into the Pacific Ocean at a point west of the Los Angeles Harbor, through a submerged multiple outlet in about 60 ft. of water about half a mile offshore. From this outlet it is 9 to 12 miles in either direction to the nearest bathing beach. Surveys, soundings and borings are now being made of this ocean outfall preparatory to making the final designs.

The plan described was designed in the office of the county surveyor, J. E. Rockhold, under the direction of the writer, sanitary and drainage engineer. Under a joint arrangement, the writer was recently appointed chief engineer of all the districts participating.

Power on the Eagle River in Colorado

The potential power of the Eagle River in Colorado, below Red Cliff, amounts to 28,000 hp. for 50 per cent of the time and 13,500 hp. for 90 per cent of the time. At the present time only 325 hp. is developed. The total fall of the river from Red Cliff to its mouth, a distance of 53 miles, is 2,440 ft., practically all of which could be developed in 14 power plants, according to a report prepared by the Department of the Interior.

Engineering Literature

A MONTHLY REVIEW OF BOOKS AND A LISTING OF NEW PUBLICATIONS

Methods of Developing a Seaport

REVIEWED BY MAURICE W. WILLIAMS

Vice-President, Technical Advisory Corporation, New York City, Past President, Society of Terminal Engineers

PORT DEVELOPMENT—By Roy S. MacElwee, Ph.D., Commissioner of Port Development, Charleston, S. C.; Major, S. S., O. R. C.; etc. Former Director, U. S. Bureau of Foreign and Domestic Commerce. New York and London: McGraw-Hill Book Co., Inc. Cloth; 6 x 9 in.; pp. 456; 157 halftones and line cuts. $5.

Most of the ports of the United States have started as aggregations of individual terminals rather than as a number of terminals operating in concert, and are still being managed that way. Where public interests have taken a hand to help matters, as a rule they have attacked only the feature which seemed at the time to be the one requiring the most attention. Until now no one has laid down the principles controlling all of the features of a port as a whole, extending from that controlled by one railroad on the one hand to an entrepot served by a half-dozen on the other. The New York-New Jersey Port and Harbor Development Commission in its monumental investigation and report of 1920 only stated facts as it found them and only worked out solutions for unfavorable conditions, but did not enunciate general conclusions which the hopeful Port of Ding-ding, let us say, could apply for its own betterment. Now, for the first time in America, all of the factors are accounted for and weighed which enter into the functions of a port and must be taken into consideration if success is to be attained.

Dr. MacElwee's work as a whole is well done. His wide travel and large experience enable him to present Hamburg and Seattle as intimately as Charleston. Ports are treated according to their physical and traffic advantages in a way which is clear alike to the harbor commissioner, the railroad president, the steamship owner, and the individual in Bushville who occasionally exports a little freight. Elements like load factors, sailing routes and grain elevators, to mention but a few, are thoroughly covered, each according to its relative importance. Details seldom thought of, such as the concurrent planning of city and port facilities as exemplified at several points in North Africa, are adequately treated. The author dwells at some length on the necessity of selling a port, taking the justifiable ground that the man who routes the freight will keep on shipping through the same port until some one tells him there is a better one.

It could be wished that Dr. MacElwee did not take too positive a stand on one or two highly controversial issues, such as the canalization of the St. Lawrence River. Had he not completed the manuscript before President Coolidge delivered his Memorial Day address the author might have had a little less of the Washington attitude and a little more of the Louisiana and Massachusetts view. Most of the testimony quoted from the lighterage case should have been omitted, highly important though it was, partly because it is liable to the charge of not being disinterested, but chiefly because all the pertinent facts were ascertained and announced soon afterward by the Bi-State Commission. While not quite so positive about it as in his "Ports and Terminals," the author still tacitly holds the view that, while the engineer is generally a capable person for designing wharf-sheds and inspecting the driving of piles, he is not quite the proper one to analyze the entire port situation and prescribe accordingly, but should leave that sort of thing to an economist—from Washington. Yet he states that the late B. F. Cresson, Jr., "one of the most farsighted and progressive of all terminal engineers, was the head and dynamic force" (of the Bi-State Commission), and that its report "is without doubt the most detailed, thorough, and elaborate port investigation ever attempted." Mr. Cresson repeatedly assured the present reviewer, who during that period was consultant to the commission, that the investigation and report were primarily matters of engineering. The author's close acquaintance with Charleston makes the chapters on traffic advantages sound a little like special pleading for that port.

These are minor defects. It will probably be long before the field of port development is so well treated.

Engineer and Marshal Under Louis XIV

VAUBAN: BUILDER OF FORTRESSES—By Daniel Halévy, Translated with notes by Major C. J. C. Street, O.B.E., M.C. New York: The Dial Press. Cloth; 6 x 8 in.; pp. 256; frontispiece portrait. $2.75.

As a "fresh and striking picture of that glorious and vigorous time," to quote from the "jacket," this biography of Vauban, the great military engineer of Louis XIV, is highly commendable. To those who would like to know how the "Builder of Fortresses" wrought, the volume, although giving some pertinent information, will be disappointing, for the biographer is far more concerned with Vauban the man than Vauban the engineer, and with the Great Louis, his ambitions, his achievements, his disappointments, and his times, than with engineering. But the book is designed for the general reader rather than the engineer or even the military man. From this viewpoint it is eminently successful. It should make, too, a strong appeal to the engineer, even if it does contain less of engineering than he would like. An appendix of notes, mostly by the able translator of the book, supplies some facts the engineer-reader will be glad to know.

Vauban was far more than "Builder of Fortresses"—he was also a master in the art of their capture and destruction. He fortified not merely cities or districts. He did still more: With sincere zeal for the empire and its people he planned taxation and other much-needed reforms.

When Louis XIV turned from military conquest and destruction to the creation of Versailles he set Vauban the task of bringing a distant supply water across a marshy valley with a depression given in this book as 210 ft. Vauban recognized the difficulties involved, studied the situation with care and instead of the time honored aqueduct on arches proposed a "creeping aqueduct"—really an "inverted siphon," *to be built of*

masonry. A superior official, Louvois, tried to prove—overproved through errors in his calculations, the translator states in an interesting note—that the pressure would be so enormous as to require masonry walls, 5,443 ft. thick. Vauban then proposed to use iron pipes. Finally he was peremptorily ordered to carry out the wishes of Louis for an aqueduct true to type, something that Louis and the world could see and admire. At the royal command, Vauban set himself to the "futile" task of rearing an aqueduct of presumably unprecedented height with its piers on marshy ground. Although Vauban lessened the difficulties and dangers of the enterprise by reducing the height (apparently using pipe at the approaches) it seems that the aqueduct never functioned, or not for long.

Some years before his death Vauban was made a Marshal of France, which for him proved to be largely a worthless honor since the dignity of the office kept him from giving that close personal attention to the details of constructional and other military operations in which he delighted and to which his great successes of earlier years were so largely due.

A New and a Revised Book by Dr. Imhoff

REVIEWED BY CHARLES W. SHERMAN
Of Metcalf & Eddy, Consulting Engineers, Boston, Mass.

FORTSCHRITTE DER ABWASSERREINIGUNG—Von Dr.-Ing. K. Imhoff. Berlin: Carl Heymanns. Boards; 6x9 in.; pp. 112; 69 halftones and line cuts.

TASCHENBUCH DER STADTENTWÄSSERUNG (Taschenbuch für Kanalisations-ingenieure)—Von Dr.-Ing. K. Imhoff. München and Berlin: R. Oldenbourg. Cloth; 5x7 in.; pp. 90; 10 line drawings, 15 plates; index.

In the Preface to the first of the two books listed just above (Progress in Sewage Treatment) the author notes the fact that no book on sewage treatment has appeared in Germany during the last ten years, while the advances made in that time, in England and the United States, perhaps even more than in Germany, are such as to require description and comment. He calls attention to the fact that he has utilized patent specifications, as well as books and papers in technical journals, in obtaining his material.

Dr. Imhoff has covered his subject in considerable detail, as may be seen by the list of chapters: New Sewage Screens in America; New Types of Emscher (Imhoff) Tanks; Two-Story Sedimentation Tanks versus Separate Sludge Digestion; Septic Tanks; Grit Chambers; Application to Land; Clarification of Streams; Storm Water Basins; Collection of Gas from Sludge Digestion; Sludge Lagoons; Fertilizing Value of Sludge; Trickling Filters; Activated Sludge; Irrigation Fields and Earth Filters; Fish Ponds; Chemical Clarification; Chlorination; Industrial Wastes; Domestic Installations; Efficiency and Cost of Processes; Drinking Water and Sewage in the Ruhr Valley; Papers by the Author and his Associates. There is a bibliography and an index.

The treatment of the several subjects is much condensed. It may be noted that the extent to which the gases from Imhoff tanks are collected and utilized is much greater in Germany than here.

The second of the books under consideration here is a revised and considerably enlarged edition of Dr. Imhoff's valuable pocket-book of which the second edition was reviewed in *Engineering News*, March 13, 1913. It is essentially a handbook for designers of sewers and sewage-works, and is extremely compact and concise. The plates are nearly the same as in the earlier edition. The text has been revised and largely rewritten. The subject headings are: Essential Data; Design of Sewers; Static Computation of Arched Sections; Design of Treatment Works (amount and character of sewage, sewage screens, sedimentation plants and sludge disposal, biological and chemical processes); Conversion Diagrams. The section relating to sewage treatment is based in large measure upon the book reviewed above.

It is hardly necessary to state that any publication by Dr. Imhoff is worthy of careful study. These two little books contain much valuable information in very small space. They will be of decided value to sewerage engineers who are able to read German.

Railway Transportation

PRINCIPLES OF RAILWAY TRANSPORTATION: By Eliot Jones, Ph.D., Professor of Economics in Stanford University; author of "The Trust Problem in the United States," "The Anthracite Coal Combination in the United States." New York: The Macmillan Co. Cloth; 6 x 9 in.; pp. 607. $3.50.

THE BUSINESS OF RAILWAY TRANSPORTATION: Traffic—Rates—Regulation—By Lewis H. Haney, Ph.D., Professor of Economics, New York University; Director of the New York University Bureau of Business Research; sometime Special Examiner for the Interstate Commerce Commission. Author of "A Congressional History of Railways," "Business Organization and Combination," "History of Economic Thought," etc. New York: The Ronald Press Co. Cloth; 5 x 8 in.; pp. 613; 37 maps and charts. $4.

Of the two volumes listed above, the first one, by Professor Jones, deals with railways from the economic and government control viewpoints, while Professor Haney's book is concerned chiefly with freight transportation. (The second review is repeated from our issue of Feb. 19, where by mischance it appeared under the title-heading of the book by Professor Jones.)

To any one wishing an insight into the fundamentals of railroad financing, rate structures and legislation, or to any one wishing to refresh his memory on these subjects, Professor Jones' book may be recommended without reservation. Written primarily to serve the needs of teachers in elementary courses in transportation, it will serve a much wider field on account of its thorough covering of the subject, its clearness and impartiality, and because of the interesting way in which it is written.

The volume is divided into a number of parts and opens with an introduction made up largely of the details of the financial structure of the railroad and an historical sketch. Following this is a part dealing with rates, including a chapter on the classification of freight; and a part explaining the legislation, both state and federal, for the regulation of railroads prior to the World War. This section deals with some of the famous legal battles, such as the Minnesota rate case and the Granger cases, with the Interstate Commerce Act of 1887, the Hepburn Act and the Mann-Elkin Act of 1910. The subsequent parts of the book deal with the war and post-war history of the railroads, valuation, regulation of securities, combinations, failures, labor troubles, government ownership and operation, and the Esch-Cummins Act of 1920.

Coming now to the book on the freight service, by Professor Haney:

The engineer is the master toolmaker. His business it is to provide and maintain all those complicated agencies through which man wrests a living from his environment. We are too prone to think of his products as mere inert structures, as a dam, a highway or a

building. Especially is this true of the civil engineer so much of whose work is in terms of fixed structures. It is hard to think of his achievements in dynamic terms and yet they all are tools forged for the use of industry, of commerce or of the community.

Because of this it is helpful for the engineer to read a book such as Professor Haney's. He tells of railways, not as a succession of cuts and fills, bridges and culverts, ties and rails, but rather as a transportation machine, a tool of modern commerce. "This volume," he says in his Preface, "discusses the railway business primarily from the standpoint of the consumer of railway freight service," in other words from the viewpoint of the user of the tool. It is always worth while for the toolmaker to hear his work discussed from that viewpoint. So engineers in general, and railway engineers in particular, will find much to interest them here. Some of the matter on theory of rates they may pass up, but the chapters on organization and operation they will want to read. So, too, with those on railway accounting and geography and with Part V, which deals with the procedure of handling freight through the traffic department.

Altogether the book is a handy and concise survey of its subject, "The Business of Railway Transportation," with the addition perhaps of a qualifying adjective to limit it to the freight end of the business.

For South Africans and Others

THE PRINCIPLES OF IRRIGATION ENGINEERING, with Special Reference to South Africa: Based on a Course of Lectures Delivered at the University of Cape Town—By Francis Edward Kanthack, C.M.G., M. Inst. C.E., M.I. Mech. E., etc., lately director of Irrigation for the Union of South Africa. London and New York: Longmans, Green & Co. Cloth; 6 x 9 in.; pp. 299; halftones and line cuts. 30s. American price, $5.

Designed for the needs of irrigation engineers in South Africa, this volume should be of much interest and considerable value to irrigation engineers in other parts of the world as well; in fact it should appeal to all engineers concerned with the utilization of water, whether for irrigation, municipal supply or power. This breadth of appeal lies in the fact that the book includes one of the latest of all the general reviews of the literature of rainfall, runoff, and water storage, subjects which present problems common to the water-works, irrigation and water-power or hydro-electric engineer. The main topics of the book are South African Rainfall, which rightly comes first; runoff, floods, and protection against them; reservoir and canal losses; storage; silt, duty of water and canal capacities; distribution of water; "brak" or alkali; and irrigation law. In each of these chapters, except the one on local rainfall, both South African and world-wide data are presented and their application to local conditions is considered. In subject matter, method of presentation by the author and in the publisher's work of manufacture the book is a commendable one.

Financial Planning for Cities

MUNICIPAL BUDGETS AND BUDGET MAKING—By A. E. Buck, National Institute of Public Administration, New York Bureau of Municipal Research. New York: National Municipal League. (National Municipal League Monograph Series.) Boards; 6x9 in.; pp. 77. $1.50.

It is fitting that the first of a projected "series of monographs" dealing "in a practical and helpful manner with the technical phases of local government and administration" should be devoted to planning the finances of cities, a subject of fundamental importance too generally overlooked or at least misunderstood and poorly handled. In conception and execution the book promises to serve its main purpose, which is to set forth the essentials of sound budget procedure for the benefit of both officials and students.

PUBLICATIONS RECEIVED

THE PORTS of Portland and Astoria, Ore., and Vancouver, Wash., the ports of Los Angeles, Long Beach, San Diego, and San Luis Obispo, Calif., and the ports of Port Arthur, Sabine, Beaumont and Orange, Tex., are described in Port Series No. 11, Port Series No. 13 and No. 14 respectively. These three publications make up the seventh, eighth and ninth volumes of a series of reports upon the ports of this country being prepared by the Board of Engineers for Rivers and Harbors, War Department, in co-operation with the Bureau of Research, United States Shipping Board. Each volume gives full information with regard to port and harbor conditions, port customs and regulations, services and charges, fuel and supplies, and railroad and steamship lines. The reports are illustrated with maps of the various ports and with numerous airplane pictures. The railroad rate situation as affecting competition between transcontinental railroads and intercoastal steamship lines is discussed in each report (Superintendent of Documents, Government Printing Office, Washington, D. C., Port Series No. 11, $1.10; Port Series No. 13 and 14, 75c.).

RIVER GAGING METHODS AND APPLIANCES suitable for use in England is the subject of a report by Dr. M. A. Hogan, prepared for the Committee on Gaging Rivers and Tidal Currents, British Department of Scientific and Industrial Research. The report summarizes experimental and other studies made under the direction of the committee. Various types of weirs and weir experiments, an American and two Swiss current meters, and related matters are outlined by Dr. Hogan. The committee, in a prefatory note, states that the "most generally useful type of meter on the market appears to be the small Price meter as used in America." H. M. Stationery Office is the publisher of the report, which may be obtained for 2½ shillings at Adastral House, Kingsbury, London, W. C. 2, and various sales agencies throughout the world (referring to the various H. M. Stationery Office publications) "usually" from the British Library of Information, 44 Whitehall St., New York City.

VOLUME 21 of the *Proceedings* of the American Concrete Institute, giving the report of the papers and committee reports at the annual convention last February, has just been published. This issuance is some six weeks earlier than the normal publication of this volume. The book contains the usual collection of excellent papers on concrete, together with the reports of the many technical committees of the institute. The secretary is Harvey Whipple, 1807 East Grand Boulevard, Detroit, Mich.

A SECOND EDITION, enlarged, of Bulletin 9 of the Structural Materials Research Laboratory, Lewis Institute, Chicago, "Quantities of Materials for Concrete," by Duff A. Abrams and Stanton Walker, has been issued. The principal subject-matter of the Bulletin is a series of tables of proportions and quantities for portland cement concrete for varying compressive strengths, using fine and coarse aggregates of different sizes, and concrete of a wide range of workability as measured by the slump test. The tables are based on the water-ratio method of proportioning concrete developed in the Structural Materials Laboratory as a result of many thousands of tests. They differ principally from tables by other authors in that the proportions have been selected with definite strengths in view, and take into account the quantity of mixing water as well as the size and grading of the fine and coarse aggregates. A method of taking into account the differences in volume of materials when measured in the laboratory and when measured under field conditions is also described. The descriptions

of field and laboratory test methods have been enlarged and include recent changes in the standards of the American Society for Testing Materials.

A BULLETIN of the University of Washington Engineering Experiment Station on Lowering the Cost of Concrete in the Pacific Northwest, by Prof. Ira L. Collier, describes experiments made in the application of some of the current methods of proportioning concrete to obtain better results. The report recites certain tests that were made and indicates the importance of the correct water cement ratio and of proper proportioning, and at the end includes some tabular and diagrammatic matter from which proportioning design may be made somewhat easier. (Seattle, Wash.: University of Washington; 35c.)

SOME OF THE DATA included in a paper on Fire Resistance in Concrete Columns, by W. A. Hull and S. H. Ingberg, U. S. Bureau of Standards, have already been reported to engineering societies, but the printed document now available gathers together the full history of the experiments, together with the conclusions. It is the most complete study yet made of the subject. (25c. from Superintendent of Documents, Washington, D. C.)

THE RAILWAYS OF CENTRAL AMERICA AND THE WEST INDIES, the fifth of the trade promotion series published by the Bureau of Domestic Commerce, U. S. Department of Commerce, presents very detailed information with respect to all the railways in Central America and the West Indies, covering such phases as the development of the line, the mileage, operating officials, methods of purchase, finances, traffic statistics, characteristics of the right-of-way, number of employees, motive power and rolling stock, repair shops and equipment. (70c. from the Superintendent of Documents, Washington, D. C.)

PETER GILLESPIE AND R. C. LESLIE, of the University of Toronto, Toronto, Ont., have computed tables on the safe load and other properties of concrete-incased I-beams and published them in Bulletin No. 5 of the School of Engineering Research of the University. The tables are based on tests made two years ago by the Dominion Bridge Co. on floor panels 10x16 ft., and a later test on an 8-in. concrete-incased I-beam of 9 ft. 2 in. span at the University of Toronto. It was concluded that the steel and the concrete act together as in reinforced concrete, and that with normal tensile and compressive stresses in the materials a horizontal shear stress in the concrete of 240 lb. per sq.in. might be allowed. The authors propose that since steelwork in fireproof construction usually has the beams incased in concrete, the strength added by this incasement should be taken advantage of to reduce the required amount of steel. In order to make tables for ready design applicable, they propose certain standard dimensions for the incasement, the bottom width being equal to the flange width of the I-beam plus 4 in., the side slopes 1 in 10, and the plane at the bottom of the floor slab located at the height of the beginning of the upper fillet of the I-beam web. For such section, they have computed their tables on the basis of a tensile stress of 16,000 lb. per sq.in. in the steel and a compressive stress of 650 lb. per sq.in. in the concrete. The incased beams show an average increase of strength over the bare steel beams of about one-third.

BULLETINS 223 and 224 of the U. S. Bureau of Mines are devoted to Surface Machinery and Methods for Oil Well Pumping, by H. C. George, and Protection of Oil and Gas Field Equipment Against Corrosion, by R. Van A. Mills (148 and 127 pp., illustrated; 50 and 35c., from Superintendent of Documents, Washington, D. C.).

PROMPTNESS IN PUBLICATION is as commendable as unusual on the part of technical societies. A notable case is the *Proceedings* of the New Jersey Sewage Works Association, at its meeting on March 27 of this year, which was in the hands of members on June 11. (John R. Downes, secretary, Bound Brook, N. J.)

WHEAT PRICE STABILIZATION during the World War and its effect upon producers has been reported on in some detail by Frank M. Surface, Economist, United States Grain Corporation, in a 100-p. pamphlet published by that organization (Washington, D. C.). There is a foreword by Herbert Hoover.

New Books and Revised Editions

[Those desiring copies of the books listed below or mentioned elsewhere in this section should order them from the publishers or from their local booksellers.]

AMERICA'S GREATEST DAM, MUSCLE SHOALS, ALABAMA: Description and Pictorial Illustration of Muscle Shoals—By Wm. Benjamin West, B. S., Alabama Polytechnic Institute, Assoc. M.A.I.E.E., Associate Editor, *Commercial News-Record*. Second Edition, Revised. New York: Frank E. Cooper (253 Broadway). Cloth; 11x8 in; pp. 62; many halftones, 2 maps. $2.

A pictorial and descriptive résumé of the construction of the Wilson Dam at Muscle Shoals, America's greatest dam.

CHEMISTRY OF ENGINEERING MATERIALS—By Robert B. Leighou, M.S., Professor of Chemistry in the Carnegie Institute of Technology. Second Edition. (International Chemical Series.) New York and London: McGraw-Hill Book Co., Inc. Cloth; 6x8 in.; pp. 538; 88 halftones and line cuts. $4.

In the present edition of this textbook, the author states in his Preface, the chapters on "fuels, iron and steel, corrosion, non-ferrous metals, and non-ferrous alloys have been almost entirely rewritten and a great deal of new material has been added," while "more attention has been given to metallurgical processes and the chapters on boiler waters, lubricants and primary electric cells have been largely rewritten and recast." The first edition, under the title, "Chemistry of Materials of the Machine and Building Industries," was reviewed in these columns June 21, 1917, p. 603.

DER EISENBETON: Seine Berechnung und Gestaltung—Von Rudolf Saliger, Dr.-Ing. ord. Professor an der Technischen Hochschule, Wien, usw. Fünfte new bearbietete und erweiterte auflage. Leipzig, Germany: Alfred Kroner. Bound; pp. 635; 480 abbildungen und 137 zahlentafeln. 24 marks, gold, in Germany.

DIE EISENKONSTRUKTIONEN DES HOCHBAUES: Für den Schul- und Selbstunterricht sowie zum Gebrauch in der Praxis—Von R. Lauenstein, weil. Baurat und Professor an der Baugewerkeschule in Karlsruhe. Erster Teil: Das Eisen und seine Verbindungen. Sechste Auflage, Bearbeitete von Prof. P. Bastine, in Karlsruhe, Baden. Paper; 7x19 in.; pp. 265; 311 abbildungen, zahlentafeln. Paper, 5 marks; cloth, 6.5 marks, gold, in Germany.

THE EMPIRE MUNICIPAL DIRECTORY AND YEAR BOOK FOR 1925-1926. London: *Municipal Engineering* and the *Sanitary Record* (The Sanitary Publishing Co). 43rd Annual Issue. Cloth; 7x19 in.; pp. 336; illustrated. 10s. 6d., net; post free 11s.

Covers 1,865 local authorities in England and Wales, 330 in Scotland, and 157 in Ireland, or 2,352 in all, besides the many cities and towns of Canada and other oversea dominions and colonies. The reviews of "municipal activities" deal with road construction, plain and reinforced concrete, lighting, heating and ventilation, motor vehicles, water supply, sewerage and sewage works, health matters, street cleaning and refuse disposal, fire prevention, housing and town planning, labor-aiding plant and appliances, recreation grounds, municipal and technical societies, and "where to buy."

THE ENGINEERING INDEX: 1924. New York: The American Society of Mechanical Engineers. Cloth; 7x9 in.; pp. 711. $7; $6 to members; three indexes, 1922, 1923, 1924, combined price of $17, $14 to members.

The sixth issue of this valuable annual since it was taken over by the American Society of Mechanical Engineers. The first volume in the series covered the period 1884-91. The value of the work is partly indicated by the fact that in preparing the 1924 issue "over 1,300 periodicals, reports and other publications received by the Engineering Societies Library during the year" were reviewed.

ENTWERFEN IM KRANBAU: Ein Handbuch für den Zeichentisch—Von Rudolf Krell, O. Professor der Technischen Hochschule, München. In 2 Banden: I Band, Text; II Band, Tafeln; und einer Beilage: Elektrische Kranaurüstungen—von Oberingenieur Christian Ritz. München und Berlin: R. Oldenbourg. Linen; 9x13 in.; I Band, pp. 214, II Band, 99 tafeln, Beilage, pp. 32; 1052 abbildungen (halftones and line cuts and plates); index. 32 marks, gold, in Germany.

A detailed work on crane design which gives promise of being useful to such manufacturers of cranes as can read German.

LINIENFÜHRUNG—Von Erich Giese, Dr.-Ing. ord. Professor, a. D., Otto Blum, Dr.-Ing. ord. Professor an der Techn. Hochschule zu Hannover, und Kurt Risch, Dr.-Ing. ord. Professor an der Techn. Hochschule zu Hannover. [Handbibliothek für Bauingenieure (herausgegeben von Robert Otzen): II Teil, Eisenbahnwesen und Städtebau, 2 Band.] Berlin: Julius Springer. Boards; 7x10 in.; pp. 435 184 halftones and line cuts; Index. 21 marks, gold, in Germany.

SCHWINDSPANNUNGEN IN TRÄGERN AUS EISENBETON: Ein Beitrag zu ihrer Theorie samt Ableitungen von Gebrauchsformeln auf Grund neuerer Versuche—Von Ingenieur Leopold Herzka, Hofrat, Vorstand der Fachgruppe für Brückenbau der osterr. Bundesbahn-Direktion, Wien-Nord-Ost. Leipzig, Germany: Alfred Kroner. Paper; 7x10 in.; pp. 137; 29 abbildungen und zahlreichen tabellen. Paper, 5.5 marks; bound 7.5 marks, gold, in Germany.

SHOP AND OFFICE FORMS: Their Design and Use—By Wallace Clark, Consulting Management Engineer; M. Am. Soc. M. E., Am. Management Assoc., Taylor Soc. New York and London: McGraw-Hill Book Co., Inc. Cloth; 6x9 in.; pp. 139; 37 charts; index. $2.50.

Takes up purposes of forms, their simplification, design, and printing; forms for storekeeping, production, cost keeping, maintenance and inspection, sales, estimating, and purchasing; stockrooms for forms, organizing a committee on forms, and use of forms to control works.

Letters to the Editor

This department aims to be a forum for the discussion of the views of engineers and contractors. The range of interest should be as wide as possible. Contributors are, therefore, asked to make their letters short.

What A. A. E. Is Doing on Professional Ethics Problems

Sir—The letter from H. B. Sweet printed in your issue of June 4, 1925, commenting on the writer's article "Outstanding Practice Problems of the Profession" and on your editorial "Tempering the Competitive Urge" in *Engineering News-Record*, May 21, 1925, are encouraging evidence of the real interest of practicing engineers in the charting of the border line between ethical conduct and its violation in the practice of our profession.

The cited article was intentionally limited in scope to the study of a few related questions arising from the unchecked competitive spirit in the pursuit of professional engagements.

Mr. Sweet points out, and quite properly, that there are other fields in the realm of professional ethics requiring survey and charting, such as the relation of the engineer to the client and to the public. It may be of interest to this correspondent, as well as to many other engineers, to know of some work that has been done along this line.

In the early years of the American Association of Engineers, through the vision of such men as Dr. C. E. Drayer, then secretary of the organization, it was decided to undertake the work of studying the detail questions of ethics that arise in engineering practice. It was realized that the generalizations in the excellent established codes of ethics of this association and of other engineering societies needed to be supplemented by more specific definitions of ethical conduct, and it was felt that such work lay peculiarly in the proper field of activity of A. A. E. since it was not a technical society but a national organization established to promote the welfare of the engineer through collective efforts contributing to the advancement of the standards and the standing of the profession.

Accordingly, a Practice Committee was formed to study and report rulings on individual questions of professional conduct submitted to it. Men of high standing and character served on this committee in successive years, passing on the Practice Cases that were submitted, and recording their final decisions in printed form in the association's publication, *Professional Engineer*.

When about forty of these Practice Cases were completed, many of them involving a multiplicity of ethics questions, the committee was asked to compile the adopted principles in a working code for the guidance of engineers. The writer undertook this task, under the chairmanship of E. E. Carpenter, and had the pleasure and privilege of drafting the code of "Specific Principles of Good Professional Conduct" which was adopted by the association with few changes. These specific principles, about fifty in number, are grouped under four main headings:

Part I. Relations of the Engineer to the Public.
Part II. Relations of the Engineer to Clients and Employers.
Part III. Relations of the Engineer to Employees.
Part IV. Relations of the Engineer to other Engineers.

The code of explicit guiding principles was published, in its initial form, in *Engineering News-Record* of May 24, 1923, as well as in *Professional Engineer* and in other engineering periodicals.

It was realized, of course, that the "Specific Principles" were a growing code and were capable of continued improvement through amplification and revision based on further study; and during the past two years, under the chairmanship of the writer, the Practice Committee has made a careful study of questions inadequately covered, and certain amplifying revisions have been recommended and adopted. Copies of this code of "Specific Principles" in its latest form will, upon request, be furnished to anyone interested.

The Practice Committee of A. A. E. has not been satisfied with the mere formulation of detailed rules of ethical conduct, but has endeavored to bring the subject into the lives and thoughts of engineers by inviting and stimulating their discussion of the outstanding problems. The agenda of this committee is now defined as follows:

"The Practice Committee shall consider and report on questions of ethics in the engineering profession, and shall continue to study and work out the itemized list of Specific Principles of Good Professional Conduct in such completeness that infractions of ethical practice may be specified by clause and sentence. It shall examine cases involving questions of professional ethics, formulate definite principles to govern decisions in such cases, and codify these principles with those previously established in a comprehensive body of explicit rules of practical applicability to constitute a definite guiding code of conduct for the engineering profession.

"The efforts of the Practice Committee shall also be directed to focusing attention and stimulating thought on the outstanding practice problems of the profession; to canvassing representative engineers for constructive opinions on those major questions which are on the shifting battle-line of professional ethics; and to educational publicity work, through articles and lectures, planned to raise the standards and the standing of the engineering profession."

In addition to this program, the association has inaugurated plans for co-operation with engineering schools, through furnishing teaching material and lectures, designed to train our future engineers in the basic principles and viewpoints of professional ethics.

In all these things, it is believed that the American Association is carrying on a unique and needed work for the advancement of professional standards. Any comments or suggestions from other engineers, toward increasing the scope or effectiveness of this work, will be gratefully received.

D. B. STEINMAN,
President, American Association of Engineers.

New York City,
June 10, 1925.

Has the Engineer a Poverty Complex?

Sir—In *Engineering News-Record*, May 21, 1925, p. 853, you mention adequate pay for engineers and their attitude toward their work and the remuneration therefor. I observed this quotation in the *Dearborn Independent* by a Mr. Shuey: "People who talk poor, live poor, and think poor are apt to stay poor." The piece was headed "The Poverty Complex."

Being an engineer myself and having both a father and a brother in the business, I have often noted the apologetic attitude generally of engineers when it comes to the amounts to be charged for service.

I know from personal experience that the thought of objecting to the charge may never occur to the patron until he observes and feels the uncertainty of his engineer on this point. In other words the attitude is created by the engineer himself. For the general attitude is one of apology.

P. M. LORRAINE,
Teacher of Surveying, Los Angeles Polytechnic High School.

Los Angeles, Calif.
June 2, 1925.

Manila Pier Work Resembles That at Halifax

Sir—I was much interested in reading the articles which appeared in your issues of April 30 and May 7, descriptive of the construction of new Pier 7 at the Port of Manila, P. I., particularly on account of the remarkable resemblance of this structure and of the piledriver used in its construction, to Pier 2 at Halifax, Nova Scotia, and the piledriver there used.

The Halifax pier was designed by the late Sir John Kennedy, of Montreal, in 1911, and was built by the Nova Scotia Construction Co., being completed in 1915, just ten years ago. For a description of this structure I would refer you to the issue of *Engineering News*, June 24, 1915, p. 1204. The Halifax piledriver was described in *Engineering News*, May 28, 1914. This machine was designed by W. L. Scott, of Mussens, Ltd., Montreal, and built by the Bucyrus Co.

Except for the fact that the longest piles used at Manila were 110 ft. in length as compared with a maximum of 77 ft. at Halifax, there does not appear to be any striking difference in the design of either the piles or the piledriver. The steam hammer used at Manila is no doubt the one which was built by the Union Iron Works for the

Nova Scotia Construction Co. in 1913, and which embodied certain improvements suggested by H. Lindsay of the latter company, and which was shipped to Manila from Halifax a few years ago.

When you have compared the descriptions of the Halifax work with those of the work recently completed at Manila and noted the many points of similarity, for instance, the use of brace piles cast with a camber, to mention only one, it seems that some slight acknowledgement might have been made to the work of the Canadian engineers and contractors who were the pioneers in the use of 24x24-in. concrete piles and who developed the plant to drive them.

Halifax, N. S., May 23, 1925. A. F. DYER, Nova Scotia Construction Co.

Tar Surface Treatment—Not Asphalt

Sir—In *Engineering News-Record*, May 21, 1925, p. 857 is given an extract from a report of the Committee on Maintenance of the Highway Research Council describing the new surface treatment for gravel roads as developed in Wisconsin. In this connection I wish to say that the heading of this article is incorrect, and also the label under the three cuts wherein you insert *asphalt* instead of *tar*.

We do not wish to discredit the merits of asphalt as a surface treatment for gravel roads but in order that your readers may have the correct impression of the work being carried on in this state, we are calling this to your attention. The surface treatment work carried on thus far has been practically all of a light tar and while we have not experimented very much with asphalt we are quite sure that good results may be obtained with the use of a light tar binder.

Madison, Wis., June 3, 1925. WISCONSIN HIGHWAY COMMISSION, N. M. ISABELLA, Maintenance Engineer.

Minimum Live-Loads in Building Design

Sir—The undersigned has read with interest your editorial in the issue of May 28, 1925, p. 878 entitled Simplifying Building Design.

The Study Committee of the Engineers' Club of Minneapolis, of which the undersigned is chairman, reviewed the report of the Building Code Committee of the U. S. Department of Commerce on "Minimum Live-Loads Allowable for Use in Design of Buildings" and submitted a criticism thereon about a year ago. Our committee suggested some increase in the live-load requirements for lighter construction buildings such as residences and buildings of the residence class, but in the main approved the report. The writer submitted a minority report recommending that the minimum live-loads on floors built with any form of joist construction should be based on the possible concentrated load which might be applied on one or several of these joists and not distributed evenly over the floor area and that distinction should be made in establishing minimum live-load requirements between such joist floors and floors which are so constructed that the work of carrying a concentrated load is distributed over an entire floor panel. Reinforced-concrete slabs in which the main reinforcing is in two directions and reinforced-concrete slabs of the flat slab type are included in this latter class.

Our committee took the position that it is the duty of the architect, engineer and owner to provide for whatever contingencies they consider advisable when fixing live-loads for which floors are designed so as to take care of possible future changes in occupancy and that it is not the duty of the building department to require an owner to provide for such contingencies and thus penalize owners whose buildings are built in localities such that it is unlikely that any change in occupancy requiring increased floor load will take place before the building has become obsolete and ready to wreck to make way for other improvements.

The writer believes that while the floor loads provided for in the said report, with the modifications suggested by our committee, are ample for ordinary wood-joist construction and for column footing, columns and main girders in any type of building, reinforced-concrete floors, including all types of construction, should be designed to withstand the loads which are certain to come upon them during construction, and that to confirm with such requirements the floor slabs of any reinforced-concrete or steel-and-concrete building should be designed for not less than 75 lb. per square foot of live-load.

It is customary in the construction of concrete buildings especially, to load the floors up with sand, plaster, brick and other materials after all form supports have been removed from below these slabs. It seems to the writer that the only way to prevent this would be to forbid mixing plaster or storing material on the floors of a building during construction. This procedure would increase considerably the cost of construction and would be impractical. It is the writer's observation that it is not done.

The practical way to meet these conditions is to design the slabs for sufficient live-load to take care of reasonable loads during construction. The tendency to overload wood-joist floors during construction is not so great, and if a joist is cracked, it is quickly seen and corrected. A concrete floor, on the other hand, may be damaged and the damage escape unnoticed until settlement of slabs and cracked partitions show after the building is complete and occupied.

Minneapolis, Minn., June 5, 1925. WALTER H. WHEELER, Consulting Engineer.

Decomposition of Wood Exposed to Heat

Sir—Referring to the account of foundation piles which were charred by long exposure to a comparatively low temperature, which was also made the subject of an editorial, in your issue of May 28, 1925, p. 888, it is quite well known in some circles (though it needs wider advertising) that some woods slowly decompose or char at temperatures little above the boiling point of water. Decomposition is accelerated on a rising temperature, becoming very rapid below 500 deg. F. Attempts to insulate even medium-pressure steam pipes with wood have failed for this reason. Wood may, however, withstand considerably higher temperatures if exposed to a moist atmosphere.

In the case described the piles were in sand and gravel soil which permitted water to drain away. They were probably bone dry. Their temperature could not have been very much over 225 deg. F. or they would not have lasted as long as they did. On the other hand, in a moist fine capillary soil capable of drawing up a continuous supply of moisture from below, they would probably not have charred at all.

Probably about 200 deg. F. is the highest temperature to which it is safe to expose dry, soft or resinous woods for long periods. Hardwoods probably stand up to heat a little better, though I have no data on these. Moist wood will not char at any temperature so long as it is under a pressure equal to or greater than the vapor pressure of water at the particular temperature. In fact wood may be melted without decomposing or charring by heating it to something over 1,000 deg. F. while under very high pressure in an inert gas.

Downers Grove, Ill., June 6, 1925. LEO G. HALL, Structural Engineer.

How North Jersey Water District Is Contracting with Various Communities

Sir—In an editorial note in your issue of May 21, 1925, you state, in reference to the North Jersey Water district: "The water district, after years of negotiation, is still in a sense unformed, or consists as yet of Newark only as a municipality with completed contractual relations with the water commission. . . . All or much of this could be avoided by a simpler mode of procedure, under which the commission would contract with each municipality separately, instead of with all jointly."

I am sure you will be interested to know that the latter method is the one which was finally adopted by this district when the procedure under the joint contract became inoperative due to postponement of action by one municipality.

The new contracts, which are separate with each municipality but include two other signers, namely, the city of Newark and the commission, were executed with Passaic on March 24, 1925, Paterson on June 4 and Clifton on June 10, 1925. The town of Kearny is expected to sign within the month. So that while the North Jersey District Water Commission Statute may appear to you cumbersome, still it works and is undoubtedly the only feasible method to accomplish municipal co-operation under the existing conditions in New Jersey.

Newark, N. J., June 12, 1925. ARTHUR H. PRATT, Chief Engineer North Jersey District Water Supply Commission.

News of the Week

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

Water Metering Program for Chicago Proposed

Provides Universal Installation in Ten Years—Rates Revamped to Pay for Filters

Pursuant to the water-meter stipulations of the War Department in granting a permit for the withdrawal of water from Lake Michigan by the Sanitary District of Chicago, an ordinance has been introduced into the Chicago City Council revamping the meter rates upward, adding a service charge, and charge for fire protection and providing for full metering in ten years at city expense. In the 33 whereas's preceding the ordinance are set forth in detail history of metering elsewhere, arguments, reasons, general requests for meter installations and effects on the consumption system and finances in Chicago.

The rates for the small consumer for domestic service are raised but slightly the larger burden being placed on the larger users. Rate steps of The New England Water Works Association are followed.

Service charges are set at $3 per year for ⅝ in. meters, $4.80 for ¾ in.; $8.40 for the 1-in. size and graduated up to $360 for a 12-in. meter. Three rates are written in the ordinance, $1.20 per 1,000 cu.ft. for the domestic rate, not over 3,000 cu.ft. per month; 90c. per 1,000 cu.ft. for the intermediate rate, over 3,000 but not over 33,000 cu.ft. per month, and 62½c. per 1,000 cu.ft. for the manufacturing rate, over 33,000 cu.ft. per month. The greatest source of revenue, however, is in the reduction to 10 per cent of the present 25 per cent discount for payment in 30 days. "Free water" in excess of reasonable amounts is to be paid for at meter rates. A charge is to be made for private fire protection: From $21 service charge per year for a 2-in. connection to $300 for a 12-in. line; sprinkler heads 4c. each with a minimum of $20 per year for a system of sprinkler heads; minimum charge for fire hydrant or hose connection is $20 per year.

The rate structure which was worked out by Dabney H. Maury, of Maury & Gordon, is calculated to finance the regular operation, maintenance and betterments; the installation of the meters and after Jan. 1, 1930, to provide $3,000,000 annually to apply on the construction of filters. As the filters are all to be built by 1939 it is stated that it will be feasible to make a reduction in rates equivalent to $2,500,000 per year after 1939. Despite caring for all of these extraordinary expenditures the rates proposed are stated to be "very much lower than the average rates for similar service, not only in Illinois but throughout the whole country."

Other points noted in the whereas's upon which the ordinance is based are as follows:

Chicago uses more water than any other water works system, 840 m.g.d., equivalent to 280 gal. per capital. One half of this amount is wasted, causing low pressure, serious shortage and excessive outlays for operation and extensions. In spite of the chlorine dosage under present conditions, epidemics of typhoid fever occur periodically. Filters are the surest safe guard but are not feasible unless all service is metered because of the enormous cost due to the capacity required.

John Ericson, city engineer, who has been an ardent advocate of metering to prevent waste for more than 25 years, is of the opinion this ordinance has a better chance of passage than those which have preceded it. The direct tie-up to filtration, for which he has recently drawn up tentative plans, and the Federal threat of shutting off the lake flow, are both new arguments which the aldermen will have a hard time dodging. The War Department gave the city until Sept. 7, 1925 to enact the necessary legislation for the installation of a universal metering system.

Engineering Fifty Years Ago

From *Engineering News*, June, 1875

NEW HAVEN now has 10 575-1000 miles of paved streets, of which 7 672-1000 miles are Telford pavement. The City Surveyor is very decidedly in favor of that pavement, as constructed from the material at hand, and with the care that is given to them in that city.

Tennessee River Development Plans Outlined

Proposed plans for developing the Tennessee River system were outlined at a recent meeting of the Tennessee River Improvment Association by W. G. Waldo, chief engineer of the association. They call for the erection of 12 navigation and power dams between Muscle Shoals and the origin of the Tennessee and Clinch Rivers. When completed, the 12 proposed dams will serve the dual purpose of producing electric power and of acting as great slackwater reservoirs assuring uninterrupted flow for the operation of the government power plant at Muscle Shoals, thus increasing the output of primary power at that plant. The complete system of proposed dams will have a capacity of over 2,000,000 hp. in a 12-hr. day.

Permit Granted for Bridge at New Orleans

High Level Bridge Over Mississippi Approved by War Department—Work Starts at Once

The War Department has granted a permit to the Public Belt Railroad Commission of New Orleans for the construction of a bridge over the Mississippi river, near Avondale, just above New Orleans. The bridge is to be 130 ft. above sea level and will have a clearance under the fixed center span of 108 ft. at maximum high water. The gradient of 1.25 per cent will begin at the end of the center span and continue uniformly throughout the entire length of the approaches. At the shore line the bridge will be 123 ft. above sea level. It will allow passage of loaded ships at all times, but some ships when traveling light will have to telescope their topmasts during high water.

The total length of the bridge proper will be 3,570 ft. The center piers are to be 30 ft. thick, to be connected with a 790-ft. span. The railroad approaches will be 8,000 ft. long, and the roadway approaches about one-third that length.

The Belt Railroad Commission at first tried to secure a permit for a low-level bridge equipped with a 420-ft. draw span. This met with determined opposition from the Navy Department, the city of Baton Rouge, the Standard Oil Co., the American Steamship Owners' Association, and others interested in shipping. The opposition made such a good case that a change of design was offered before the Chief of Engineers had made his recommendation on the original application.

Construction work on the approaches was begun by the Commission on June 15. Ralph Modjeski is consulting engineer for the bridge.

Vehicular Tunnel Proposed for Tampa Bay Crossing

A vehicular tunnel to connect Gadsen Point on what is known as Interbay Peninsula with the mainland is to be built by a company which, according to the Tampa Board of Trade, has been organized and financed and only awaits approval of its plans by the War Department before starting construction. The plans call for causeway approaches on each side of Tampa Bay and a tube from 1½ to 2 miles long to connect them. The proposed tunnel is to be wide enough for four lines of automobiles and sufficiently far below the surface of the bay at the ship channel to allow for a future channel 30 ft. deep.

Gadsen Point is about 7 miles southwest of Tampa and is reached by a main highway. On the mainland side there are two main highways which will be connected with the proposed vehicular tunnel.

Julius Kruttschnitt Dies in New York

Civil Engineer, Chairman of the Executive Committee of the Southern Pacific

Julius Kruttschnitt, who retired from the position of chairman of the executive committee of the Southern Pacific System on June 1 after occupying the position for 13 years, died of a heart attack on June 15 while convalescing in a hospital in New York following a slight operation. Mr. Kruttschnitt had been in the service of the Southern Pacific continuously for 40 years at the time of his death. He was a native of New Orleans, where he was born in 1854, and a graduate with the degree of civil engineer from Washington & Lee University in 1873. After leaving college he taught school until, in 1878, he became resident engineer on the construction of a railroad extension by Morgan's Louisiana & Texas Road & Steamship Co., later becoming road master, assistant chief engineer, chief engineer, and superintendent. In 1885 the Southern Pacific leased the road and Mr. Kruttschnitt was made assistant general manager of the Atlantic System, becoming general manager in 1889. At the same time he was made vice-president of the Galveston, Harrisburg & San Antonio and of the Texas & New Orleans R.R. In October, 1895, Mr. Kruttschnitt was made general manager of the Southern Pacific System and became a vice-president in April, 1898. In 1901, when E. H. Harriman obtained control of the Southern Pacific and became its president Mr. Kruttschnitt was made fourth vice-president and assistant to the president, and in 1904 he was made director of maintenance and operation of the entire Harriman System, in which position he shared with J. C. Stubbs, traffic director of the Harriman Lines, the responsibility for the successful operation of the entire system. At that time Mr. Kruttschnitt moved his headquarters to Chicago.

When the Harriman System was broken up in 1913 Mr. Harriman remained with the Southern Pacific, becoming chairman of the executive committee with headquarters at New York. Mr. Kruttschnitt retired from this position on June 1, having reached the age limit set by the company's pension system. He was to have continued as a director of the company.

Schools of Aeronautics Founded at New York University

The chancellor of the University of New York has announced that Daniel Guggenheim has given the university $500,000 to establish a school of aeronautics in the university's college of engineering. Mr. Guggenheim, in making the gift, said in part: "I have learned through my son, who was one of the first civilians to enter aviation and was a naval aviator overseas during the World War, of the plans of the New York University to establish a school of aeronautics in its college of engineering. I take pleasure in making possible the accomplishments of this desire. I understand that approximately $225,000 of the fund will be required for building and equipping a building, a wind tunnel, propeller laboratory, and testing laboratory, model shop, full light laboratory, power plant laboratory, and classroom. I understand that the balance of the fund will be required to provide for salaries of a professor and assistant and for the maintenance of the building and equipment." The chancellor has announced that the school will be known as the Daniel Guggenheim School of Aeronautics.

Water-Supply and Sewage-Disposal Problems at Cleveland

Serious questions as to the future water-supply and sewage-disposal policies of Cleveland, Ohio, were raised in two papers read before the Cleveland Engineering Society on June 10. One of these papers was on "The Water and Sewage Problem of Cleveland," by J. W. Ellms, engineer of water purification and sewage disposal, and the other was entitled, "Plans for Meeting the Sewage Treatment Problem of Cleveland," by George B. Gascoigne, formerly in the engineering department of Cleveland in charge of the design and construction of the two existing sewage-works and now designing (in his private practice) a third sewage-works for Cleveland. Both papers were largely historical and descriptive but each raised questions as to future policy, as already stated.

In brief, Mr. Ellms stated that studies made by him in 1920 and 1924 indicate an increasing range of lake pollution by the sewage of the city, which, taken in connection with a possible new water pumping station in the vicinity of the easterly sewage-works, certain lake-front improvements made or proposed and lack of space at the easterly and westerly sewage-work sites suggest pumping the sewage from those sites to a new one where more land is available for treatment commensurate with possible future needs.

Mr. Gascoigne's paper, apparently not written as a reply to Mr. Ellms', but addressed in part to current talk in the city, advanced the idea that the easterly and westerly works are doing all that their designers and several consulting engineers expected them to do; that a longer period of operation than two years and more analytical data are needed before deciding whether these works, with projected extensions at the easterly plant, will prove to be sufficient for many years to come; that there is no immediate urgency for a change in the sewage-works program; and that both the future water supply and future sewage disposal problems of the city need study, including cost estimates, before decision on anything definite. It appears from Mr. Gascoigne's paper that there has been advocacy in some quarters of building an activated-sludge plant at the easterly sewage-works, where as yet coarse screens and grit chambers only have been installed, with summer disinfection to protect bathing beaches.

Reclamation Land Holders Warned to Pay Up

An earnest warning to land holders on federal reclamation projects to pay up their delinquent operation and construction charges has been sounded by Elwood Mead, Commissioner of Reclamation, in connection with the denial of wholesale applications by water users on the Boise reclamation project for deferment of their overdue charges. According to an announcement just given out by the Department of the Interior, 392 water users on this project made application for extension of time on water rental and drainage charges, after irrigation began and after relief from payment of irrigation charges amounting to over $1,000,000 had been granted. The showing of inability to pay was inadequate, however, and the applications were denied.

In an accompanying memorandum, Dr. Mead says that the Congressional Relief Acts of May 9 and Dec. 5, 1924, "are not designed to facilitate and encourage the evasion or postponement of legitimate charges, the payment of which is within the financial ability of the water users. This fundamental fact unfortunately appears to have been ignored by many. The evidence is not wanting to support the conviction that many water users have refused to make payment in any case regardless of financial ability, believing that under the act of Dec. 5, 1924, all back charges will be funded and a three-year moratorium will be granted in every case, even though not urgently needed, merely because the law affords authority for such action." He points out that the postponement of payments menaces the good repute of reclamation and its continuation as to government policy as well as the prospect of further reclamation. Nearly $2,000,000 of charges on the Boise project are overdue.

Suit Over Skagit Tunnel Contract Charges Conspiracy

R. M. Grant & Co., bond brokers, have filed suit in the U. S. District Court at San Francisco to recover $177,425 from R. C. Storrie & Co., principal contractor on the Gorge tunnel of Seattle's Skagit power project, this sum of money having been advanced, it is claimed, during the progress of the work. Countercharges filed by the defendant allege irregularities in the award of the contract.

The Storrie company in its denial and countercharge claims that three bond houses doing business in Seattle practically compelled it to enter into a conspiracy to obtain more than $2,000,000 of utility bonds of the City of Seattle below par, contrary to law and in fraud against the city. It is charged that the three bond houses conspired to obtain the municipal utility bonds at unlawful discount by inducing the contractors to raise their bids sufficiently to absorb the discount, and by promising contractors certain concessions and rebates. Meantime state examiners have been going over the city's Skagit books, checking expenditures item by item.

WASHINGTON NOTES

The Denison bill authorizing the construction of toll bridges as a part of a federal-aid highway project will be pushed at the next session of Congress. The highway commissions of a number of states are anxious to secure this legislation to meet situations where an unusually expensive bridge must be constructed. Under conditions such as are provided in the Denison measure, it is believed that toll bridges can be operated without abuse. The bill provides that the tolls must be reasonable and just. The Secretary of War is authorized to prescribe legal rates at any time he may see fit.

Another provision of this legislation gives general authority to the Chief of Engineers to grant permits for the construction, maintenance and operation of bridges and approaches over navigable waters. This is intended to do away with the requirement that separate legislation be secured for each bridge. The requirements of the existing law frequently make for delays. Bridge bills always are passed perfunctorily once that they are brought before either house of Congress, but there frequently is delay in getting the measure ready for a final vote.

The President's Muscle Shoals Commission in its session held on June 10 emphatically went on record against any formal disposition of Muscle Shoals power prior to action by Congress. This opinion was expressed in answer to a letter from the Acting Secretary of War in which the views of the commission were sought on proposals to make temporary leases of the power and nitrate plant. The commission, however, left to the War Department the determination of the question of the sale of the power which shall become available incident to the testing of the machinery and the equipment.

The staff of the Federal Power Commission has decided to reject the application of the Nevada Irrigation District for use of public lands in connection with the storage and diversion of water of the Middle Yuba River and of Canyon Creek, in California. The executive secretary of the Commission has outlined to the Nevada district a modified form of application. The following conclusions have been reached by the commission's staff: (1) Your project as outlined is believed to be of doubtful economic feasibility, and to be less economical of development with the Middle Yuba storage and diversion than without it. (2) It is the opinion of disinterested investigators that it will never be economical to irrigate more than 75,000 acres in the district. Water to irrigate 75,000 acres can be obtained without diversion from the Middle Yuba. (3) If the District should divert Middle Yuba water as proposed, such diversion would curtail irrigation of more productive lands in the Sacramento Valley which can obtain water from no other source at a reasonable cost. It would also cause the postponement of, or possibly prevent, a comprehensive power development on North Fork Yuba River. (4) Your project as applied for does not conform to the requirement of the Federal Water Power Act that it be best adapted to a comprehensive scheme of improvement and utilization for the purposes of navigation, of water-power development, and of other beneficial public uses of the water resources of the region.

The Yuba River Power Company has applied for rights on the north fork of the Yuba. The Excelsior Water and Power Company has filed an application covering a project on the Middle Yuba. The three applications overlap.

Changes in Terminal Plans Save Money for Philadelphia

Changes that effect a saving to the City of Philadelphia were made on June 10 at a hearing before the Commitee on Transportation and Public Utilities of City Council, in the agreement between the city and the Pennsylvania Railroad Company for the construction of a new terminal in Philadelphia and for city improvements in connection with the terminal. The original agreement as drafted by engineers of the city and the railroad company, provided that the city should pay for the removal of the elevated structure of the railroad between 15th and 18th Sts. The amendments approved by the committee eliminate a charge of $300,000 against the city for this purpose. They also provide that 20th St. shall be widened to 90 ft. instead of to 120 ft. as was originally intended. No reduction in costs to be charged against the city will be made on account of this reduction in the street width. The saving on street work is estimated at about $50,000, however, making the net saving to the city $250,000. The total cost to the city for the improvements is now estimated at about $15,677,000. The agreement will be acted upon by City Council after the loan bills providing funds for the work have been passed.

Ann Arbor R.R. Sold to Wabash

A recent announcement by the president of the Wabash Railway Co. states that his company has purchased the Ann Arbor Railroad Co. subject to the approval of the Interstate Commerce Commission. The Ann Arbor R.R. has a mileage of 292, and in addition operates car ferries on Lake Michigan.

In the Interstate Commerce Commission plan for the consolidation of the railroad, the Ann Arbor R.R. was assigned to a system in the Michigan Peninsula built up around the Pere Marquette. The announcement of the purchase of the Ann Arbor by the Wabash closely following, as it does, the announcement of the leasing of the Buffalo, Rochester & Pittsburgh Ry. by the Delaware & Hudson Co., is generally conceded to be an indication that a fifth trunk line railroad system is being built up in the East by the Interests which control the Delaware & Hudson and the Wabash.

Bardo and Backes Resign from the New Haven R.R.

Clinton L. Bardo, general manager, New York, New Haven & Hartford R.R. Co., and William J. Backes, assistant general manager, have both resigned. The announcement of the resignations came immediately after the announcement of the appointment of W. L. Bean, mechanical manager, to replace L. N. Reed, resigned, and it is generally believed that they were due to dissatisfaction over the changes in the mechanical department. Mr. Bardo, a railroad operating officer who gained his early experience on the Lehigh Valley and who served for a time with the New York, New Haven & Hartford during the presidency of Charles S. Mellen, was appointed general manager of the New Haven in 1913, and has served as such since that date. Mr. Backes has been with the New Haven since 1906. Previous to his becoming assistant general manager, he was engineer of maintenance of way and before that chief engineer of the Central New England, a subsidiary of the New York, New Haven & Hartford.

Petition Denied in Chicago Diversion Case

The petition to re-hear the Chicago diversion case noted in *Engineering News-Record* June 4, 1925, p. 950, was denied by the United States Supreme Court on June 8. Denial of the motion for a re-hearing finally disposes of the case before the Supreme Court.

Civil Service Examinations

UNITED STATES

For the following civil service examinations apply to the U. S. Civil Service Commission, Washington, D. C., or to any local office of the commission.

Junior Cartographic Engineer—Vacancies in the U. S. Coast and Geodetic Survey, Washington, D. C., at entrance salary of $1,860 a year with possibility of advancement to $2,400 and of promotion to higher grades; requirements are that applicants must have graduated in a civil engineering course from an institution of recognized standing. The work of a cartographic engineer is connected with the compilation and correction of the nautical charts of the Survey.

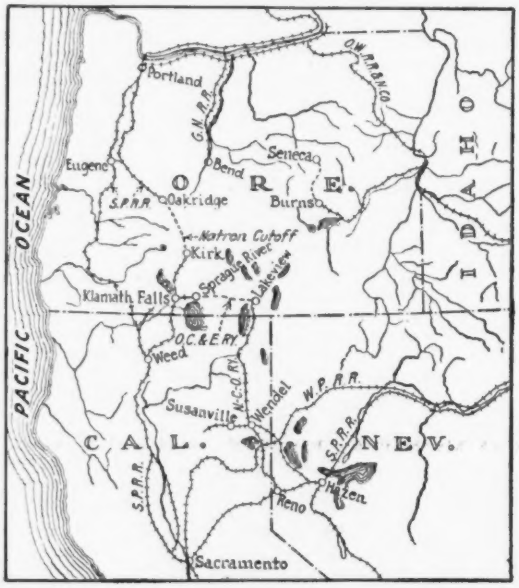
Technical Assistant in Sanitary Engineering — Vacancy in U. S. Public Health Service at Cincinnati, Ohio, entrance salaries $1,500-$2,200 a year, for work pertaining to stream pollution, sanitary surveys, the treatment of water, sewage and industrial wastes, drainage and other sanitation measures.

Structural Steel Draftsman—Vacancies in the Lighthouse Service, Department of Commerce, throughout the United States, entrance salary $2,100.

Applications for the examinations for cartographic engineer and sanitary engineer, as named above, must be received before June 27 and for structural draftsman before July 11, 1925.

Railroads Not Fighting for New Territory in Oregon

Following a statement in one of the San Francisco daily papers, to the effect that the Southern Pacific Co. has authorized the expenditure of $30,000,000 in a war to shut out an effort of the Great Northern R.R. to tap the rich Southern Pacific territory in northern California and southern Oregon. The president of the Southern Pacific Co. issued the following statement: "The Southern Pacific is not at war with anybody but is attending strictly to its own business. Southern Pacific does this by careful attention to the service it gives the public and by the development of the territory it serves and adjacent to it. It is true we are building the line through Klamath Falls, sometimes known as the Natron Cutoff. Litigation over the Central Pacific held us back from this work for several years after we had put a large sum of money into the construction, but as soon as we were permitted to do it we resumed and now have the rails laid on 52 miles of new construction, have 30 miles more ready for rail, with the remaining 26 miles of mountain line fully 50 per cent graded, making 108 miles of new line in all. On the new construction we have spent already some 10 millions of dollars with some millions more appropriated to complete the work.



"This gives us two lines from Weed to Eugene through some of the loveliest country in the world and puts Klamath Falls on main line. All of this received, in due course, the approval of Interstate Commerce Commission.

"R. E. Strahorn has been for some time engaged in constructing a line to serve the territory to the East and Northeast of Klamath Falls which is without a railroad. He has already built 40 miles to Sprague River. As his construction aims to serve territory contiguous to our line, and naturally tributary to Klamath Falls, we have undertaken to aid in his construction upon obtaining approval of the Interstate Commerce Commission for us to do so. This will enable his road, called the Oregon, California & Eastern, to accomplish the construction in the most convenient and least expensive way, and he is well on his way with the 40 miles he has already built.

"We have been prompted to this by the further consideration that from our Susanville Branch at the point named Wendel, a narrow gauge road, of which Charles Moran is president, known as the Nevada-California-Oregon Ry. runs northerly 156 miles to Lakeview, Ore. The people along this line have been constantly pressing him to change the road to standard gauge because the transfers from narrow gauge to standard gauge make any considerable lumbering operations impossible. Mr. Moran having desired our help to accomplish this upon the call of the people along his railroad, we have responded favorably and there is no secret about it, that if the commission gives consent, Southern Pacific will finance the standard gauging of that railroad. The Southern Pacific is its only connection and that road is a natural feeder to our Central Pacific line to the East as the Strahorn line out of Klamath Falls is a natural feeder to our Natron Cut-Off.

"It is natural that the public should next look for tying together of these two pieces of road in order to make a new line in South-Central Oregon, giving Western and Southern Oregon a new outlet to the east by way of the Southern Pacific's Fernley line through Nevada and making much the shortest route to the East.

"This is all in accord with Southern Pacific's general policy which looks to the development of the territory it serves. These new additions come in natural sequence to the railroad building which we are now doing.

"We have not figured on building to Bend. We have not regarded Bend as tributary to our line, it being already well provided with railroad facilities, but if a line were to be built to Bend we are in the best position to build it as one more step in the large development we have already put upon the map.

"Let me say once more, however, that we are not at war with anybody."

The projected line of the Great Northern is from Bend south to Klamath Falls. Another project is for a line from some point near Burns in eastern Oregon in a westerly direction, either to Bend or to some point on the Southern Pacific line near Kirk. The Northern Pacific recently purchased 160 acres of land in Klamath Falls, presumably for a terminal site for a line from Bend.

Details of the projects were given in *Engineering News-Record* Oct. 16, 1924, p. 635, Jan. 15, 1925, p. 104, and April 16, 1925, p. 666.

Random Lines

An Old Friend

Perhaps the hoariest joke in the engineering field is that one about the young engineer who rushed to the scene of a washout to take charge of the reconstruction of a bridge and who, when he asked the old construction boss the whereabouts of the design drawings for the new structure which were to have come from headquarters, was answered: "I don't know anythin' about your pitchurs, but there's your bridge." We are therefore glad to greet it in new form in a serious editorial on the status of the engineer in London *Engineering*, which says: "Some branches of the profession must always partake much more of the nature of an art than of a science, as was strikingly exemplified during the American war of succession (sic) when an experienced contractor replaced a railway bridge before the professional corps of engineers had thought out their preliminary plans."

* * *

Another Hazard of Construction

Atlantic City, June 4.—Shapely bathing girls in one-piece suits were blamed today by Superintendent of Construction G. F. Nourse for the much criticized delay in the completion of the new Absecon Boulevard to this city.

There is a swimming pool at Absecon which is popular with fair mainland damsels.

"These girls go past in one-piece suits," said Nourse, bitterly, "and my whole force lays off work while they are in sight. We often lose fifteen minutes of work at a time while the girls are going by. If the swimming pool were closed to them while this job is under way, we'd make much more progress."—New York *Herald-Tribune*.

* * *

Old Stuff

To save the effort and postage of more interested friends we will say that we have seen, and hereby note, that the Colorado State Teachers' College at Greeley, Col., has just added to its curriculum a new course which it calls Janitor Engineering. But we must note that some high school has beaten them to it, as exclusively announced in this column in the issue of January 1, 1925. Our files now contain about 50 clippings, including editorial comment from some of the larger papers in the East, with the far west still to be heard from.

* * *

News Item

Some people up Niagara Falls way are getting worried because they say that the steel arch bridge just below the falls, connecting New York State with Ontario, has gotten into the habit of swaying under light loads, but curiously enough pedestrians seem to notice this swaying only when en route from Ontario to New York. Beer of 4.4 per cent alcohol content has just been made legal and available in Ontario.

Engineering Societies

Calendar

Annual Meetings

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION, University of Pittsburgh; Annual Meeting, Union College, Schenectady, N. Y., June 17-20, 1925.

AMERICAN SOCIETY FOR TESTING MATERIALS, Philadelphia, Pa.; Annual Meeting, Atlantic City, N. J., June 22-26, 1925.

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York City; Summer Meeting, Salt Lake City, July 8-10, 1925.

AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS, St. Petersburg, Fla.; Annual Meeting, Des Moines, Iowa, Oct. 26-29, 1925.

The New Haven Chapter, American Association of Engineers, at its annual meeting May 19, elected the following officers: President Thomas K. Hendrick, vice-presidents Lewis C. Smith and Charles E. Mar, treasurer Julian F. Denison, secretary Philip Sellers, and assistant secretary Clarence I. Smith.

The American Road Builders' Association has announced that its annual convention and Road Show will be held Jan. 11-15, 1926, in Chicago. The Road Show will be held in the Coliseum and the adjoining building. The place in which the sessions of the convention will be held will be announced at a later date.

The Baltimore Section of the American Society of Civil Engineers at its meeting May 19 elected the following officers for the coming year: Herman P. Doeleman, president; Ralph F. Proctor, vice-president; and C. E. Keefer, secretary-treasurer.

The New England Water Works Association has nominated the following officers for the coming year: President, Theodore L. Bristol, Ansonia, Conn.; vice-president, George A. Carpenter, Pawtucket, R. I.; and treasurer, Albert L. Sawyer, Haverhill, Mass.

Montclair Society of Engineers, at its annual meeting June 3, elected as president Edward S. Cole, president of the Pitometer Co., New York City.

Personal Notes

BATCHELLER & KNEEN, INC., consulting engineers, is the name of a new firm which has opened offices at 929 Dexter Horton Building, Seattle, and which is conducting a general engineering practice. WILLIS T. BATCHELLER has been in the engineering field in this district for the last fifteen years, specializing in hydro-electric development, irrigation, water supply and hydraulic projects, having been connected with the Columbia Basin Irrigation Project and the Skagit River power development. O. H. KNEEN has specialized in general industrial practice, including investigations of a business and financial nature, plant designs and installations, and management.

H. M. LUMSDEN, assistant development engineer, Canadian Pacific Ry., Department of Colonization and Development, has been placed in charge of the development of natural resources on western lines of the system with headquarters at Winnipeg, Man.

E. U. STEVENSON, who for the last four years has been with the U. S. Bureau of Public Roads at Fort Worth, Texas, has accepted a position as field engineer with the Portland Cement Association for work in Arkansas. Mr. Stevenson's headquarters will be Little Rock.

D. A. YOUNG is appointed valuation engineer of the Chicago River & Indiana R.R., the Chicago Junction Ry., and the Indiana Harbor Belt R.R., with headquarters at Chicago, vice A. A. SCHMIDT, resigned to accept service with another company.

GEORGE W. SIMONS, JR., who for nine years has been chief engineer of the Florida State Board of Health, has been appointed chief engineer and secretary of the Consolidated Development & Engineering Corporation, Inc., of Jacksonville, Fla.

A. V. RUGGLES, at one time connected with *Engineering News*, and later for many years engineer in the water department of Cleveland, Ohio, holding successive positions up to that of commissioner of the department, has joined the organization of the United States Cast Iron Pipe and Foundry Co., to become special representative of that company in Cleveland.

W. B. MAY, assistant engineer, St. Paul Union Depot Co., St. Paul, Minn., has been promoted to principal assistant engineer; and H. E. WOLFF, designing draftsman, has been promoted to assistant engineer of design.

F. J. STIMSON, chief engineer of maintenance of way of the southwestern region of the Pennsylvania R.R., at St. Louis, and T. W. PINARD, acting assistant chief engineer of maintenance of way of the northwestern region, at Chicago, have been appointed assistant chief engineers of maintenance of way of the new western region.

T. J. SKILLMAN, chief engineer of maintenance of way for the northwestern region of the Pennsylvania R.R., at Chicago, has been appointed to the same position for the new western region, which combines the former northwestern and southwestern regions.

JOHN H. PORTER is to be appointed a member of the Missouri Public Service Commission, according to an announcement made by the governor of Missouri. Mr. Porter is a graduate of the University of Georgia and has been practicing civil engineer in St. Louis for the past five years. During the war he served with the Engineer Corps in France, later going to Serbia as a member of one of the four technical missions created to study disrupted railroad facilities of Europe.

EDWARD B. ELLICOTT, consulting mechanical and electrical engineer, Chicago, has been appointed by the mayor as member of the Board of Education, and has been elected president of the board. He was city electrician for several years.

KENNETH S. GUITERMAN, consulting engineer, 120 Broadway, New York City, has been made a member of the firm, at that address, which will now be known as Henry Gardner, Guiterman & Co.

E. W. CONSTANTINE, civil engineer, has been appointed assistant designing engineer by the Alabama State Docks Commission, and has therefore resigned his position with the Alabama Power Co., Birmingham, Ala.

HENRY WELLES DURHAM has been appointed chief engineer to plan the municipal works of sanitation for the city of Managua, Nicaragua, by R. W. Hebard & Co., of New York City. Contract for the work was let to R. W. Hebard & Co. by the Nicaraguan government.

MAJOR CAREY H. BROWN, Corps of Engineers, U. S. Army, has been assigned to duty in the office of the director of public buildings and parks, Washington, D. C., and CAPT. ELLIS E. HARRING has been relieved from duty in that office and assigned to special duty with the Arlington Memorial Bridge Commission.

Obituary

WILLIAM HUDSON, aged 65 years, superintendent of the municipal waterworks at Doyleston, Pa., during the recent period of extreme heat became despondent because his plant was unable to furnish water enough to meet the increased demand of householders and shot himself; he died a few hours later. For a week residents of the borough had been unable to get water from taps in the upper floors of houses, even though use of water for washing automobiles and other non-essential uses had been forbidden, and the constant telephone calls to the water-works superintendent preyed upon his mind.

BRIG. GEN. CHARLES E. L. B. DAVIS, Washington, D. C., retired officer of the Corps of Engineers, died June 4 in a hospital at Atlantic City, N. J. Born in Connecticut in 1844 and a graduate of the U. S. Military Academy in 1886, General Davis's service up to the time of his appointment as a brigadier general in 1898 was in the Corps of Engineers. At various times he was in charge of various engineering works at New Orleans, Galveston, Sabine Pass, Buffalo, Detroit, Milwaukee, Washington, D. C., and San Francisco, and in the Philippines. He was stationed at Detroit when retired for age in 1908.

From the Manufacturer's Point of View

A Point of Contact Between Maker and User of Construction Equipment and Materials

Standards for Pressure Filters to Be in Water Works Manual

Announcement was made at a special meeting of the executive committee of the Associated Manufacturers of Water Purifying Equipment, held at the Engineers Club, Philadelphia, May 27, that the standard specifications for pressure filters adopted by the association had been accepted for inclusion in the Manual of Water Works being prepared by the American Water Works Association.

The Associated Manufacturers of Water Purifying Equipment was organized in September, 1918. The members of the executive committee of the association are: Churchill Hungerford, Hungerford & Terry, Inc., general chairman; Jesse W. Roberts, Roberts Filter Mfg. Co., vice-chairman; Arthur M. Crane, secretary-treasurer; M. F. Newman, Wm. B. Scaife & Sons Co.; J. W. Ledoux, Simplex Valve and Meter Co.; W. J. Orchard, Wallace & Tiernan Co., Inc.; J. D. Yoder, Cochrane Corp.; and G. F. Hodkinson, American Water Softener Co.

Motor Vehicle Production in May Below Record Month of April

Production of motor cars and motor trucks in the U. S. totaled 404,300 in May, according to the estimate based on shipping reports submitted to the National Automobile Chamber of Commerce. Production was 4 per cent under the total for April, which was a high-record month. Despite the decrease from April, output is 33 per cent ahead of May 1924. Dealers' reports show that used cars as well as new automobiles and trucks are selling actively.

Business Notes

WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, Pa., has recently shipped what is said to be the largest water-wheel generator of the horizontal type that has yet been constructed. This equipment will be used by the California Edison Co. in its Big Creek No. 1 station to aid in supplying electrical energy for a 220,000-volt transmission system about 200 miles long. Operating at 300 r.p.m., the generator develops 28,000 kva. at 11,000 volts. A voltage of 12,500 and 31,000 kva. can be developed with the rotor running at 360 r.p.m.

AMERICAN ROLLING MILL CO., Middletown, Ohio, reports sales for 1924 at $28,679,818, against $26,691,234 in 1923, showing a gain of $1,988,584. The net income for 1924 was $2,845,055, after depreciation, federal taxes and interest, compared with $3,472,898 in the preceding year.

FRANK SHANLEY, foreman in charge of sewer construction, Chicago Bureau of Sewers, has developed the Shanley reversible manhole cover to a commercial basis after several years' use in the Bureau. This type of cover, described in detail in *Engineering News-Record* Nov. 30, 1922, p. 928 is now set in all new work and replacements by the Chicago Street Department and Board of Local Improvements. On the expiration, May 1, of an exclusive right to manufacture, held by Love Bros., Aurora Ill., B. J. Shanley was appointed manufacturer's agent to handle sales. Local foundries will be licensed to make the covers since it is not feasible to ship much beyond a radius of 300 miles.

UNIVERSAL PORTLAND CEMENT CO., Chicago, reported that a 100 per cent record for industrial safety was achieved in each of its mills during April. The record is a rather remarkable one, not only because of the thousands of workers employed, but because normal operation had been speeded up during this period to meet the heavy demand of spring consumption.

STEPHENS-ADAMSON MFG. CO., Aurora, Ill., manufacturer of conveying, transmission and screening machinery, has established a sales engineering office in San Francisco under the management of Charles E. Bruff, formerly of the mining engineering firm of Bradley, Bruff & LaBarthe.

J. V. N. DORR, president of the Dorr Co., New York, sailed for England, June 9 to attend a meeting of the American Institute of Chemical Engineers at Leeds. Following this meeting he will go to Bucharest as a delegate to the International Congress of Pure and Applied Chemistry.

RIEHLÉ BROTHERS TESTING MACHINE CO., Philadelphia, Pa., manufacturers of testing machines for nearly 100 years, have announced the opening, on May 1, of a new branch sales office at 30 Church St., New York, under the direction of Abbott F. Riehlé. The company expects to establish branches in other cities as rapidly as the expansion and growth of sales warrant.

GEORGE A. MUIR, who has been connected with the Denver office of the Allis-Chalmers Mfg. Co., for the past five years, and for ten years previous to that with the machinery department of the Mine & Smelter Supply Co., Denver, has been elected to the office of president and manager of the Advance Machinery & Supply Co., Denver, Colo. The latter company is manufacturer's agent for De Laval Steam Turbine Co., Trenton, N. J.; Yarnall-Waring Co., Philadelphia, Pa.; S. F. Bowser & Co., Fort Wayne, Ind.; Betson Plastic Fire Brick Co., Rome, N. Y.; "S-C" Regulator Mfg. Co., Fostoria, Ohio; Heine Chimney Co., Chicago, Ill.; the Uehling Instrument Co., Paterson, N. J., and the Viking Pump Co., Cedar Falls, Iowa.

T. L. SMITH CO., Milwaukee, Wis., has appointed I. E. Schilling Co., Miami, Fla., as its representative for the state of Florida. G. C. Kenney will handle the sales of Smith pavers in the territory in and around Kansas City, Mo.

Equipment and Materials

Mortar Delivered by Belt Conveyor Up 44-Degree Incline

Transporting mortar on a smooth belt conveyor up a 44-deg. incline into a third story window is the latest application of the portable type N conveyor manufactured by the Barber-

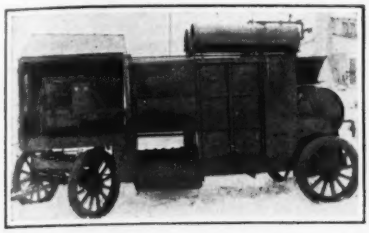
Greene Co., Aurora, Ill. The experiment was made in connection with the construction of a school building in Denver, Colo., by Henry & Feely, contractors. Although the conveyor is ordinarily equipped with wheeled trucks, these were removed for this work. The conveyor is 60 ft. long and 18 in. wide, driven by a 15-hp. Le Roi gasoline engine.

Portable Asphalt Plant

The portable asphalt plant of the Chausse Oil Burner Co., Elkhart, Ind., designed for repair work, consists of a four-cylinder gasoline engine connected to a two-cylinder air compressor, 80-gal. asphalt tank, tool heater compartment, 18 individual batch boxes, mill type mixer and four oil burners. It is designed to heat 3 cu.yd. of mix per day. It is mounted on four rubber-tired wheels, is self-propelling at low speeds but is not intended to be driven over long distances. Sufficient capacity for 25 gal. of fuel is provided which is sufficient for a 10-hour run.

The compressor furnishes sufficient air for the burners and for blowing out holes and cracks in the pavement to be repaired; one or two pneumatic tools for ramming or picking may also be operated. The batch box arrangement permits putting new material into the heating compartments when

the hot mix is removed. Each batch box holds 1½ cu.ft. of material. The hopper over the mixing drum also holds 1½ cu.ft. so that material shoveled directly into the hopper can be readily



measured. The impeller blades rotate in a direction opposite to that of the drums so as to secure a thorough mix. Two of the burners are under the tool heating compartment, and the other two are under the mixing drum. It is claimed that 80 gal. of asphalt can be brought to working temperature in 35 min. The top of the machine is insulated so that the air supply tank and fuel tank are not subject to direct heat. The plant weighs 6,000 lb. empty, and is 12 ft. long.

Reinforced Dump Bodies Made for Hard Service

A dump body, designed particularly for rough usage and known as the "Chicago Type," has been added to the line of equipment manufactured by the Heil Co., Milwaukee. It is built with a wearing plate of ⅜ in. steel on top of 3/16-in. flooring. It has four side braces and a channel reinforcement along the top. A 4 x 4 x ⅝-in. T-iron is placed across the front of the body and across the middle of the tail gate. On the inside of the body are stake pockets so that additional sides can be added.

The tail gate is suspended by a ⅝-in. link chain and is reinforced with a 3 x 3 x ⅜-in. angle. The operating mechanism is controlled by a handle located under the body runboard, and easily

accessible from the cab. The load may be dumped either over or under the tail gate. To facilitate rapid and wide dumping under the tail gate, the hinges are set back 8 in. from the rear of the body.

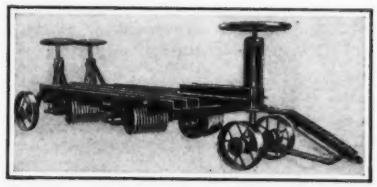
200-Ft. Clarifiers to Be Used as Pre-sedimentation Units

Four 200-ft. clarifiers manufactured by the Dorr Co., N. Y., are to be used as pre-sedimentation units in the new Kansas City, Mo., water treatment plant. The clarifiers are designed to give 3 hr. detention to the capacity flow of 100,000,000 gal., and will remove continuously from 8 per cent to 90 per cent of the suspended matter from the raw Missouri River water. These units will be of the peripheral drive type and substantial savings are expected from the advantages to be obtained from continuous sludge removal.

Although clarifiers are operating successfully as sedimentation units in many water treatment plants, this installation marks the first occasion that such large units have been installed for this type of work. However, similar units have been operating in the mining field for many years.

New Road Disk

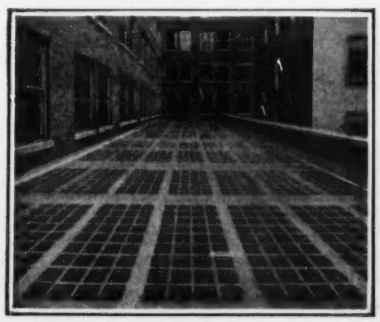
The No. 4 road disk is the newest product manufactured by the Killefer Manufacturing Co., Los Angeles, Calif. By this machine the waves or corduroy



are taken off a highway and when this disked material is graded to the center and into the depressions the street is rolled. The disks are spaced 2 in. apart on the shafts and work on a strip 3 ft. 9 in. wide, cutting 2 in. below grade. The machine has a 15-ft. wheelbase, weighs 8,000 lb. and its weight platform is 5 ft. 4 in. wide by 10 ft. 6 in. long.

Skylight Units of Great Strength

A skylight which requires no protecting screens and which can be walked on is offered by the American Bar Lock Co., Inc., Long Island City, N. Y. The skylight is built of reinforced-concrete ribs, 3¾ in. deep, supporting each glass unit on four sides. The glass is protected against expansion with a composition which also waterproofs all points of glass contact. Each unit of glass is surrounded for its full perimeter with hard ductile alloy frames which provide protection against pressure of concrete caused by expansion. Expansion joints are formed at suitable intervals to relieve pressure, calked and made watertight with oakum and a special compound. The skylights are designed for spans with a maximum of 10 ft. in the clear. They are shipped in completed factory-finished slabs, ready to be installed by local labor, or the factory will send its own mechanics



if desired. The manufacturer furnishes a guarantee to replace free any glass that may be broken within five years.

Water-Borne Wood Preservative

Utilized in Europe for the last twenty years a wood-preserving mixture of fluoride and dinitrophenols or cresols has recently been put on the market in this country under the name of Wolman salts. It is claimed that a water-borne mixture of these salts is more easily absorbed and diffused through the cellular structure of sap wood than are oil-borne toxins. A mordant is used to bring about a fixation of the chemicals in the fibers to prevent leaching. The salts are soluble enough to make up hot solutions but are non-hygroscopic and non-deliquescent.

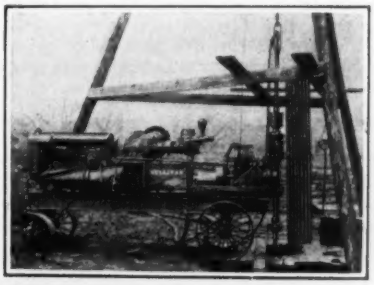
Other advantages claimed are absence of corrosive action on metals and to a certain extent the salt renders the wood non-inflammable, is odorless and without effect on workmen. Treated wood can be worked over and painted.

In application a full-cell impregnation is preferable. It is best applied to timber thoroughly air seasoned in the open. If not seasoned, steaming to expel moisture must be resorted to. A vacuum is drawn and maintained while the solution is introduced. Pressures of 100 to 125 lb. are maintained while the solution is pumped into the cell until the added quantity indicates complete penetration. The remaining solution is drained off to the storage reservoir and the treated timber stacked in open piles to dry.

Wolman salts are made up under patents and distributed in this country by the American Wood Impregnation Corporation, New York City.

Gas Engine Drive for Diamond Drill

A new diamond drill has recently been put on the market by the Sullivan Machinery Co., Chicago. This drill is



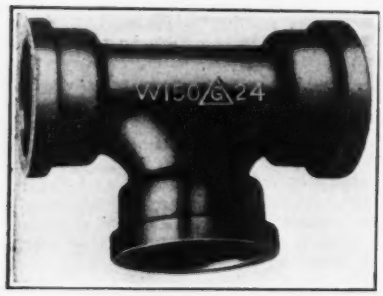
mounted at one end of a steel truck having wide tired steel wheels, and is operated by direct connection from a Fordson tractor power plant on the other end of the truck. A duplex double-acting high-pressure pump is mounted on a bracket between the engine and drill, and provides wash water for the drilling. For hoisting and handling stand pipes, rods, etc., the regular hoisting drum has ample power and change of speed. The connecting shaft between the drill and the engine telescopes so that the drill may be

slid back when hoisting or lowering the rod.

The outfit weighs about 7,800 lb. and may be moved anywhere a team can go. A small electric generator with three Ford headlights provides illumination for night drilling. The machine is built in sizes for cutting cores from 1¼ to 2 in. in diameter and for putting down holes to depths of 2,000 ft.

New C. I. Socket Fittings Made with Medium Radius Bends

As a result of a series of investigations with water-works socket fittings using various radii, the Grinnell Co., Providence, R. I., determined that a medium radius would give less resist-



ance to water flow than a larger radius. Since these findings checked similar tests made by the U. S. Bureau of Standards and the Underwriter's Laboratories, the company designed a new socket fitting of medium radius that is lighter and more compact than the older type. All socket and spigot dimensions are the same as American Water Works Association Standard Class D pipe, as are also the wall thicknesses. The fittings are suitable for 173 lb. water pressure as specified for Class D pipe.

The value of the compact fitting made possible by the reduced radius is especially pronounced in making connections through building walls, pit walls, or other places where the space is limited. The fittings have been tested and approved for fire protection work by the Underwriter's Laboratories and the Mutual Insurance Companies.

Publications from the Construction Industry

Digging Buckets — McMYLER-INTERSTATE Co., Cleveland, describes the Fogarty digging bucket in its bulletin No. 71. The bucket is attached directly to an operating arm and is forced into the bite by means of the line pull, the weight of the operating arm, and the weight of the bucket. The bulletin tells what the bucket does, how it works, and how to use it.

Pile Hammers — McKIERNAN-TERRY DRILL Co., New York, has recently issued an 80 p. booklet describing its complete line of pile hammers. The booklet, No. 35, contains many descriptions of installations for pile driving and pile pulling. Specification and duplicate-part tables are given for each size and type of hammer as an aid in ordering.

Drill Steels—GILMAN MFG. Co., East Boston, Mass., in Bulletin 102, describes its line of drill steels for hammer rock drills. Tabular specifications are given for each individual drill steel set, the types of which include quarter octagon, round, auger, and hexagon drill steels. Specifications and decriptions are also included of Gilman air drill hose and hose assemblies and fittings.

Surveying Instruments—KOLESCH & Co., New York City, has issued the twelfth edition of its illustrated catalog and price list. The book contains 300 pages profusely illustrated, covering its entire line of surveying instruments and accessories, as well as drawing materials and supplies.

Hoisting Apparatus — AMERICAN HOIST & DERRICK Co., St. Paul, Minn., shows in a 48-p. booklet how "American" locomotive cranes are built and operated and in attractive illustrations depicts the uses to which they may be put in the construction and material-handling fields.

Material-Handling Machinery — BARBER-GREENE Co., Aurora, Ill., in a 24-p. booklet gives pictures and information on typical jobs to show the flexibility, economy, and adaptability of equipment manufactured by this company to a contractor's every-day problems. This equipment includes self-feeding bucket loaders and portable conveyors, and the illustrations show these and other equipment in actual operation.

Hoists—NOVO ENGINE Co., Lansing, Mich., devotes a large portion of the March issue of its house organ, *Novo Power*, to a description of the Novo LH single- and double-drum hoist, the newest industrial outfit built by the company. It is a contractor's hoist, capable of handling loads up to 3,000 lb.—large enough for use on small construction jobs and small enough to be used as an auxiliary unit on big projects. The hoist is powered with Novo single-cylinder 6, 8 or 10-hp., two-cylinder, 6- to 12-hp., and four-cylinder 12- to 18-hp. industrial engines.

Speed Transformers — POOLE ENGINEERING & MACHINE Co., Baltimore, Md., has issued bulletins on two new types of transformers for increasing or decreasing speeds. Bulletin 105 treats of the Poole Type H and Bulletin 106 of the Poole Type K. The uses to which these transformers can be put are enumerated.

Screws, Bolts and Rivets—PHEOLL MFG. Co., Chicago, has issued a 92-p. thumbed-index catalog containing complete data on its line of screws, bolts, rivets, threaded wires and nuts. The catalog also contains reference tables on all screw thread standards and also on thread and nut dimensions for screws and bolts.

Business Side of Construction

FACTS AND EVENTS THAT AFFECT COST AND VOLUME

Steel Demand More Active Than A Year Ago—Other Materials Gaining In New Business

According to the trend of the market for basic building materials, steel should soon show an improvement in demand consistent with that for lumber, cement, etc.

Despite a drop of 9 per cent in steel demand as reflected by unfilled orders on books of the U. S. Steel Corporation, May 31, compared with those on hand April 30, there has been a gain in new business during the first two weeks of June over that for the corresponding period last month.

UNFILLED STEEL TONNAGE ON BOOKS OF U. S. STEEL CORPORATION

1925	Tons	1924	Tons
Jan. 31	5,037,323	Jan. 31	4,798,429
Feb. 28	5,284,771	Feb. 29	4,912,90[illegible]
Mar. 31	4,863,564	Mar. 31	4,782,807
Apr. 30	4,446,568	Apr. 30	4,208,447
May 31	4,049,800	May 31	3,628,089

It is evident from the above tabulation that the steel demand has been consistently heavier thus far this year, than during the first five months of 1924.

The report of the National Lumber Manufacturers Association, June 11, announces a marked increase in new business, especially in the West Coast mills.

THE NATIONAL LUMBER MOVEMENT

	Week of June 6 Ft. b.m.	Corresponding Week in 1924 Ft. b.m.	Preceding Week in 1925 Ft. b.m.
Production	250,576,763	224,722,878	237,745,504
Shipments	244,470,893	221,981,571	250,231,251
New Business	252,401,238	185,458,287	223,401,262

Concerning cement, the Geological Survey reports that the May output was the greatest for any single month on record. Shipments were also the highest yet recorded for that month in any preceding year. Expansion of demand is being met by increased production with the result that reserve stocks are over 13 per cent higher than at this time last year.

CEMENT SITUATION AT MILLS

	Production Thousand Barrels		Shipments Thousand Barrels	
	1924	1925	1924	1925
First Quarter	27,746	28,145	20,138	21,456
April	11,726	13,807	12,771	14,394
May	13,777	15,503	14,551	16,735

CEMENT MILL STOCKS AT END OF MONTH

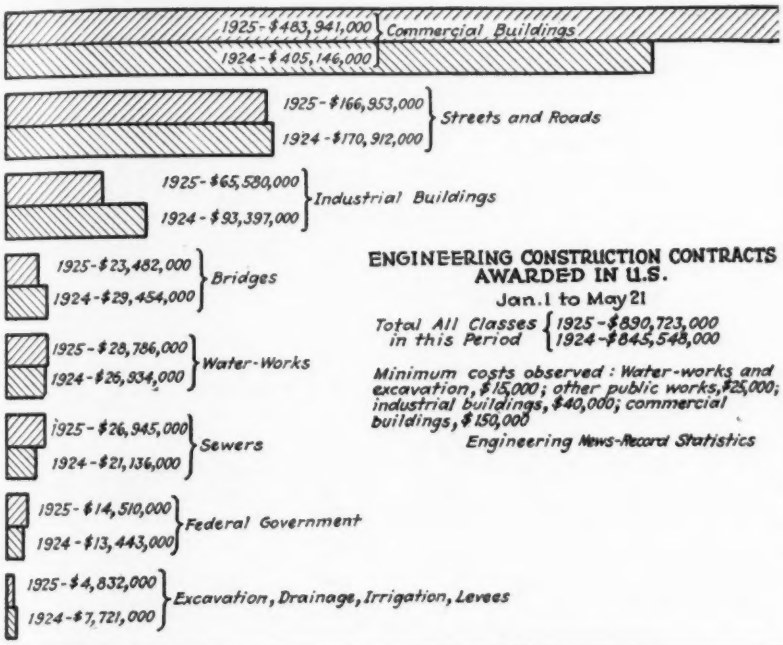
	1924 Barrels	1925 Barrels
January	14,155,000	17,656,000
February	16,815,000	19,689,000
March	18,189,000	20,469,000
April	17,159,000	19,877,000
May	16,403,000	18,646,000

Engineering Construction Most Active in Commercial Buildings, Water-Works, Sewers and Federal Government Jobs

Contract letting, in the eight classes of work mentioned in the chart, for the first twenty-one weeks of this year and last, shows progress in commercial building construction, water-works, sewers and Federal Government jobs.

There is some slowness, however, in streets and roads, industrial buildings, bridges, drainage and excavation work.

Commercial building construction will be most active in New England, the South and the Middle West; water-works, in the South and West; sewers in New England and the West and Federal Government projects in the West and the Middle Atlantic states.



This Week's Contracts—Week Ago—Same Week Last Year

The money value of contracts reported in the present issue of *Engineering News-Record* is here compared with the figures for corresponding weeks.

Minimum costs observed are: $15,000 for waterworks and excavations, $25,000 for other public works, $40,000 for industrial and $150,000 for commercial buildings.

MONEY VALUE OF CONTRACTS LET—ENTIRE U. S.

Week Ending	Public Work	Private Work	Total Contracts
Jun18,1925	**$26,919,000**	**$24,635,000**	**$51,554,000**
Jun11,1925	18,719,000	26,235,000	44,954,000
Jun19,1924	15,360,000	14,283,000	29,643,000
Heaviest Week			
1924, May 8	26,370,000	38,829,000	65,199,000
1925, Apr. 2	43,603,000	27,633,000	71,236,000
Jan. 1 to Date			
1925	476,113,000	612,783,000	1,088,896,000
1924	464,163,000	525,308,000	989,471,000

May Public Bond Sales Heaviest for That Month on Record

The May total of state and municipal bonds was augmented by the placing of several large issues. The total for this month was $186,892,336 according to the *Commercial and Financial Chronicle*. This amount for the month of May exceeds that of any May on record and is the third highest for any single month. June 1924 is the record month with $276,706,107 recorded and December 1921 is second with a total of $220,466,661.

New York City was the largest borrower of the month marketing $60,000,000 4¼s for school construction.

REPRESENTATIVE PUBLIC BOND SALES, MAY, 1925

State	Purpose	Amount	Rate per Cent	Sold For	Basis	Dated	Maturity	Purchased By
Alabama	Road and bridge	$7,000,000	4-4½	.....	....	.....	.....	First Nat. Bank of Birmingham
Michigan	Road	518,000	....	100.10-106.20	....	.....	2 to 10 yrs.	Detroit Trust Co. and Citizens Savings Bank of Mt. Clemens
Oregon	.....	121,890	4½	101.69	....	.....	.....	Anglo-London Paris Co. of San Francisco
County								
Alamance, N. C.	Road	600,000	4½	101.27	4.62	May 1	1928-45	Federal Securities Co. of Chicago and others
Alameda, Calif.	Hospital	500,000	5	106.007	4.30	Nov. 1	1933-37	William Cavalier & Co. and others
Allen, O.	Viaduct	39,375	5	102.65	....	Mar. 1	1926-34	Seasongood & Mayer of Cincinnati
Allegheny, Pa.	Road	2,000,000	4	100.63	3.95	May 1	Annually	First Nat. Bank of N. Y. C. and others
	Bridge	2,763,000	4					
	Court House	250,000	4					
	Tunnel	60,000	4					
Ashe, N. C.	Road	94,000	4½	100.74	4.67	May 1	1930-45	Hanchett Bond Co. of Chicago
Atlantic, N. J.	Building	170,000	4½	103.01	4.23	May 1	1927-55	B. J. Van Ingen & Co. of N. Y. C. and others
Barry, Mich.	Road	37,800	5	103.58	4.68	May 1	.....	Hastings City Bank of Hastings
Bonner, Ida.	School	5,000	5	100	5	.....	.....	State of Idaho
Broward, Fla.	Highway	200,000	6	110.11	5.14	Jan. 1	1934-48	C. W. McNear & Co. of Chicago
Buncombe, N. C.	Road and bridge	1,000,000	4½	100.06	4.49	May 1	1928-57	The Detroit Co. of N. Y. and others
Blount, Tenn.	Highway	50,000	5	108.74	4.48	June 1	1950-60	Caldwell & Co. of Nashville
Cambria, Pa.	Road and bridge	500,000	4½	102.42	3.97	June 1	1926-48	W. H. Newbold's Sons of Philadelphia
Cass, Neb.	Road	28,000	4½	100.07	....	July 1	.....	Peters Trust Co. of Omaha
Cuyahoga, O.	Sewer	1,154,000	4½	102.118	4.18	Oct. 1	1926-40	William R. Compton & Co. and others
Wasco, Ore.	Road	50,000	4½	100.11	....	May 8	.....	Ladd & Tilton Bank of Portland
Township								
Erwin, Mich.	Road	45,000	4½	103.33	....	.....	.....	Detroit Trust Co. of Detroit
Huston, Pa.	Road	25,000	4½	104.256	4.07	June 1	1927-45	E. H. Rollins & Sons of Philadelphia
Haddon, N. J.	Water	145,000	4½	100	4½	.....	.....	M. M. Freeman & Co. of Philadelphia
Municipal								
Abilene, Kan.	Paving	138,847	4½	100	4½	Jan. 1	10-20 yrs.	Brown-Crummer Co. and others, Wichita
	City Hall	125,000						
Alden, Pa.	Highway Impvt.	25,000	4½	104.01	4.02	May 1	1955	The First Nat. Bank of Clifton Heights
Apopka, Fla.	Paving	30,000	6	103.13	5.64	.....	1930-45	The Wright, Warlow Co. of Orlando
Asheville, N. C.	School Bldg.	550,000	4½	104.91	4.37	Apr. 1	1928-66	Ames, Emerich & Co. and others, N. Y. C.
	Pub. Bldg.	520,000						
	Street	600,000						
	Refund	90,000						
Albion, Mich.	Paving	20,000	4½	100.42	4.40	July 15	1926-35	Detroit Co. of Detroit
	Curb and gutter	25,000						
Auburn, Wash.	Water	100,000	5	98.65	5.12	Apr. 15	1945	Ferris & Hardgrove of Spokane
Babylon, N. Y.	Village Hall	90,000	4½	102.39	4.19	Aug. 1	1926-43	Geo. B. Gibbons & Co., Inc., of N. Y. C.
Bexley, O.	Street impvt.	208,500	5	103.69	4.10	Apr. 1	1925-33	State Teachers' Retirement System
Bridgewater, Mass.	Water	350,000	4	101.48	3.85	Mar. 1	1926-55	Old Colony Trust Co. of Boston
Black River, N. Y.	School	78,000				May 1		
	Water	7,000	5	104.28	4.42	June 1	1929-42	Northern N. Y. Trust Co. of Watertown
Cleveland, O.	Pub. Impvt.	5,173,000	4½	101.429	4.05	Mar. 1	1926-50	First Nat. Bank of N. Y. C. and others

Weekly Construction Market

PRICE advances, this week, show an increase over declines, despite the general downward trend in evidence since March of this year. In the building materials market firmness is mainly in common brick and linseed oil. The latter advanced 2c. in New York and 4c. per gal. in Atlanta during the week. Brick is up another dollar per thousand in New York. Strikes in the Hudson River district have resulted in the granting of the 1924 wage rate to the laborers, with a consequent increase in cost of production. Brick are in good demand and scarce. Telegraphic reports to *Engineering News-Record* from the Seattle district state that logging operators in the Northwest are closing down for an indefinite period. Curtailment prior to July 4, the usual time for such action, is influenced considerably by proposed increases in transportation tariffs and by fire hazards. The long standing jurisdictional dispute between bricklayers and plasterers, started fourteen years ago and affecting construction in several large cities, has finally been placed before the conciliation bureau of the U. S. Department of Labor. In this controversy the bricklayers object to the separate organization of plasterers in localities where the latter belong to the bricklayers union.

	New York	Atlanta	Dallas	Chicago	Minneapolis	Denver	San Francisco	Seattle	Montreal
Steel Products									
Structural shapes, 100 lb.	$3.34	$3.90	$4.15	$3.10	$3.35	$3.07½	$3.30	$3.35	$4.25
Structural rivets, 100 lb.	4.50	4.45	4.75	3.50	3.75	4.65	5.00	3.75	6.00
Reinforcing bars, ¾ in. up, 100 lb.	3.24	3.40	3.38	3.00	3.25	3.62½	3.35	3.25	2.30
Steel pipe, black, 3½ to 6 in. lap, discount	48%	53.2%	43%	+56½%	54.25%	36%	39.2@51%	50%	59.49
Cast-iron pipe, 6 in. and over, ton	50.60@51.60	54.00	56.00	+47.70@48.20	53.00	62.00	52.00	53.00	55.00
Concreting Material									
Cement without bags, bbl.	2.50@2.60	2.40	2.05	2.20	2.42	2.84	2.31	2.65	1.80
Gravel, ¾ in., cu.yd.	1.75	1.90	2.38	2.75	1.65	1.90	2.15	1.50	1.25
Sand, cu.yd.	1.00	1.40	2.00	2.75	1.25	1.00	1.50	1.50	1.25
Crushed stone, ¾ in., cu.yd.	1.85	2.00	2.83	2.75	1.75	2.50	2.15	3.00	1.90
Miscellaneous									
Pine, 3x12 to 12x12, 20 ft. and under, M.ft.	59.00	34.00	56.00	29.00@39.00	38.75	36.25	27.00	23.00	60.00
Lime, finishing, hydrated, ton	18.20	22.50	20.00	20.00	25.50	24.00	22.00	24.00	21.00
Lime, common, lump, per bbl.	2.50@2.75	1.45	1.85	1.21	1.35	2.70	1.60	2.80	9.50
Common brick, delivered, 1,000	+19@20	10.50	12.10	12.00	13.50@13.60	12.00	15.00	15.00	17.50
Hollow building tile, 4x12x12, per block	Not used	.0888	.10	.06	.....	.085	....	.10	.12
Hollow partition tile 4x12x12, per block	.1162	.0888	.10	.06	.07	.085	.108	.10	.10
Linseed oil, raw, 5 bbl. lots, gal.	+1.11	+1.16	1.30	1.23	1.17	1.30	1.14	1.12	1.25
Common Labor									
Common labor, union, hour	.75	.30	.....	.87½	.....	.50@.55	.55	.62½	.....
Common labor, non-union, hour	.....	.25	.30@.50	.75	.50@.55	.35@.50	.50	.50	.25@.35

Explanation of Prices—Prices are to contractors in carload lots unless other quantities are specified. Increases or decreases from previous quotations are indicated by + or — signs. For steel pipe, the prevailing discount from list price is given; 45-5% means a discount of 45 and 5 per cent.

New York quotations delivered, except sand, gravel and crushed stone, alongside dock; common lump lime, in 280-lb. bbl. net, and hydrated lime f.o.b. cars; tile "on trucks"; linseed oil and cast-iron pipe f.o.b. Labor—Concrete laborers' rate, 93¾c.; building laborers, 75c.; excavating laborers, 50c. per hr.

Chicago quotes hydrated lime in 50-lb. bags; common lump lime per 180-lb. net. Lumber, sand, gravel and stone delivered on job.

Minneapolis quotes on fir instead of pine. Brick, sand and hollow tile delivered. Cement on cars. Gravel and crushed stone quoted at pit. We quote on brown lime per 180-lb. net; white is $1.70 for Kelly Island and $1.60 for Sheboygan. Common labor not organized.

THIS limited price list is published weekly for the purpose of giving current prices on the principal construction materials, and of noting important price changes on the less important materials. Moreover, only the chief cities are quoted.

Valuable suggestions on costs of work can be had by noting actual biddings as reported in our Construction News section.

The first issue of each month carries complete quotations for all construction materials and for the important cities. The last complete list will be found in the issue of June 4, the next on July 2.

Denver quotes on fir instead of pine. Cement "on tracks"; gravel and sand at pit; stone on cars; lime, brick, hollow tile and lumber on job. Tile price is at warehouse. Linseed oil, delivered in wooden bbl. Common lump lime per 180-lb. net.

Atlanta quotes sand, stone and gravel per ton instead of cu.yd. Common lump lime per 180-lb. net.

Dallas quotes lime per 180-lb. bbl. Steel, cement, cast-iron pipe and crushed stone f.o.b. cars, other materials delivered.

San Francisco quotes on Heath tile, size 5½ x 8 x 11½. Prices are all f.o.b. warehouses except C. I. pipe, which is mill price plus freight to railway depot at any terminal. Common lump lime per 180-lb. net. Lumber prices are to dealers in yards at San Francisco, for No. 1 fir, common.

Seattle quotes on Douglas fir (delivered) instead of pine. Lump finishing lime per 180-lb. net. Brick and hollow building tile delivered. Hydrated lime in paper sacks. Sand and gravel at bunkers.

Montreal quotes on pine lumber. Sand, stone, gravel and lump lime per ton. Stone and tile are delivered; sand, gravel, lime and cement on siding; brick f.o.b. plant; steel and pipe at warehouse. Hollow tile per ft. Cement price is in Canadian funds (the Canadian dollar stands at par). Bag charge is 80c. per bbl. Discount of 10c. per bbl. for payment within 20 days from date of shipment. Steel pipe per 100 ft. net; 3½-in., $59.49.

Business Briefs

Call Money rated at 3¾ per cent; year ago, 2 per cent.

Time loans for all periods, 3¾@4 per cent.

Foreign exchange (Demand)

	Par	This Week	Last Week	Year Ago
Sterling	$4.86⅛	$4.85⅞	$4.85 11/16	$4.32⅛
Franc	.193	.0480⅛	.0487	.0552⅛
Lira	.193	.038	.0398⅛	.0435⅛
Mark	.238	.238	.2381	.....

On June 1, 1925

E. N.-R. Construction Cost Index Number 204.60

E. N.-R. Construction Volume Index Number 209

For Explanation and Details of Indexes Since 1913 See the First Issue of Every Month